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TELEPHONE ENGINEER

VOLUME 28 DECEMBER, 1924 NUMBER 12

Their Securities Find A Ready Market—

PEOPLE are usually willing to invest their money in companies that show a record of steady earnings. This one factor alone means much to the investor because it indicates success. Successful enterprises have little difficulty in getting new capital.

Among public utilities, Strowger Automatic operating companies are notably successful. They are marked by their steady growth and steady earnings.

Stabilized operating costs enable them to control their expenses. Rising labor costs, strikes and epidemics have little or no effect on their net income.

The type of service they render is a distinct asset. The quick, accurate dial service is a powerful goodwill builder. Subscribers like it and, naturally, public favor turns toward the organizations furnishing it.

These companies find that their securities sell readily and as a result new capital for extensions and improvements is easier to obtain and at smaller expense.

Strowger Automatic makes financing easier; first, because its service creates goodwill; second, because its low cost of operation allows the company to show steady, consistent earnings from year to year.

Automatic Electric Company

Factory and General Offices: Chicago, Illinois

ASSOCIATED COMPANIES

International Telephone Sales and Engineering Corporation.....New York
International Automatic Telephone Company, Ltd.....London
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MAGNETO OR COMMON BATTERY

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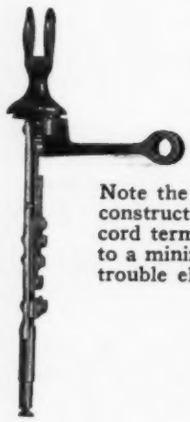
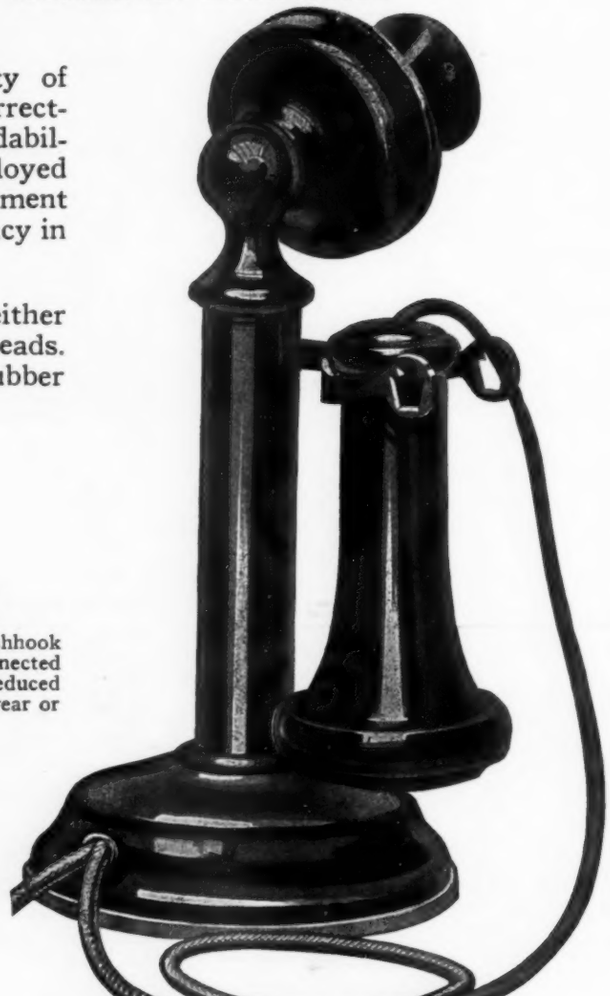


IN THE STEM

Note the simplicity of the Switchhook construction and the direct connected cord terminals. Equipment is reduced to a minimum and all possible wear or trouble eliminated.



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CHICAGO, U. S. A.

FOR OVER 30 YEARS MAKER OF GOOD TELEPHONES

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ON MAKING MISTAKES

The limitations of human nature are such that the making of a mistake is something that occurs, not once, but many times in the life of a man. Ordinarily our mistakes do not have serious consequences and, in the course of a few months or years, their effects disappear and they are forgotten. Many times they are discovered and rectified before any permanent harm occurs.

From one viewpoint, the making of mistakes has an important bearing on the development of an individual. It is expected that younger and more inexperienced men will make mistakes. Therefore, they must serve an apprenticeship under the supervision of their elders and their work must be checked carefully during this period before they are allowed to take full responsibility for it.

The value of a mistake depends largely upon the reaction of the maker. Does he shirk responsibility, or "pass the buck"; does he let discouragement take possession of him because of the error or does he acknowledge the mistake frankly and then set about to analyze the situation so that he may not make similar mistakes in the future?

We recall reading an engineering article a number of years ago in which a water supply engineer described a mistake that had been made in the methods employed to dig a well. This mistake was very expensive at the time, but it led to a study of the situation and to the development of improved methods which ultimately saved many times the cost of the original mistake. Thus the initial mistake became a positive benefit.

Lessons learned through mistakes last longer than those learned in the course of ordinary experience. The really important thing about most mistakes is to make sure that they will provide knowledge that will prevent other mistakes in the future.

A REAL ENGINEERING JOB

The planning and execution of an engineering project always involves foresight and skill and in many cases it demands self-confidence and courage of a high order. Such a case is the one described on another page where an automatic switchboard equipment was raised from the floor to provide space for new equipment. Certainly none but courageous men would attempt the work of raising 52 tons of delicate automatic switching apparatus on a false floor to a position ten feet above its former place when a single slip would mean interruption to service of thousands of subscribers. Yet so well was the work planned and so thoroughly were the preparations made that it was accomplished in a single working day without a single interruption to service. The successful completion of the job is an eloquent tribute to the ability, skill and courage of Mr. Caster and his associates in the Lincoln Telephone and Telegraph Co. and the cost figures are a strong argument for real engineering in the telephone plant.

A GOOD MOTTO FOR 1925

Good Service at a Good Rate is Good Business Policy for both Company and Subscriber.

NOT "SELLING THE UNITED STATES SHORT."

A writer on business and economic subjects whose articles appear in the Chicago Tribune under the name "Scrutator" recently had the following to say in his column: "The telephone business has been conspicuously successful in applying statistics to the problems of its future growth. It has been able to provide for the future with a minimum of waste and lost energy because it has studied the present and the past analytically."

Telephone men, almost universally, have recognized the importance of carefully prepared studies of future requirements when plant construction and additions are being planned. They have at times been criticized for what appears to the layman to be too liberal provision for future growth. A sufficiently long time has now elapsed to permit a check of the actual development against the forecasts made in earlier development studies and the results amply justify the practice of making such studies.

Some of these checks show that the development has outstripped what appeared to be very optimistic estimates and the continued growth of the business and the lack of any indication of slackening rate of increase justify a continuation of an optimistic outlook for the development of the future. As the writer just quoted says in another part of the same article, "They (telephone men) are not selling the United States short," and he further indicates that their conclusions agree with those of the most eminent students of economic conditions.

THE UNWELCOME JOB OF MOVING POLES

One of the most unwelcome requests that comes before the telephone manager is a request to move poles. Such a request may involve the moving of an entire line as frequently has happened in cases of highway construction; or, it may involve only the moving of a single pole on account of building or sidewalk construction—or, perhaps, the caprice of some individual. In any case, there is expense incurred from which there is no return, either in increased income or improved service.

In the case of highway construction, the request frequently comes from unauthorized persons, and where the company has complied with the request, in a number of cases, it has been found that the new location was unsatisfactory and a second move became necessary. Some companies very properly refuse to accept such a request unless made by some one in authority, and then only when a permanent location has been assigned by the engineers in charge of the job.

Where the request for the move comes from a property holder in cities where only one or two poles are involved, companies frequently move the pole rather than argue over the location. In one case which has come to our attention, a large pole was moved because the property owner stated that he intended to remodel an old barn into a double garage and the pole was in the way of the entrance. This was over two years ago and the barn is still waiting to be remodeled. In another case, poles were moved and cable rerouted because they were in the way of bridge construction. Later, it was found that the place assigned by the contractor for the bridge construction did not clear the work and another move was made necessary.

In both of these cases, the companies were at considerable expense but some benefit was derived in the first case because the company called the attention of the city engineer to the situation and it does not now move poles until he has approved the request. In the second case, the company rendered a bill to the contractor of the bridge for the extra work and intends to carry the matter into the courts if a settlement can not be obtained otherwise.

As a part of their policy of maintaining good public relations, telephone companies have been very liberal in acceding to requests for moving poles, but they have been imposed upon so frequently that they are beginning to study the matter and to scrutinize all such requests very carefully before agreeing to do the work. It is doubted that public welfare or the public relations of the company are served by unquestioned compliance with such requests. We believe any company is fully justified in requiring that sufficient cause be shown before such work is done and that it be protected from further expense after the move is made.

THE GREETING OF THE SEASON

Once more, as the close of the year approaches, it becomes our pleasure to write a word of greeting to those many friends and readers of TELEPHONE ENGINEER to whom a more personal and individual expression is denied us.

The season is indeed a "hallowed and a gracious time," as Shakespeare truly says; one of great joy that a Saviour was born into the world. And yet, His day is scarcely past when our joy is tempered by a certain sadness, as we see another year passing into the storehouse of time. Regret for the passing of the old changes, however, into anticipation of the coming of the new and, after a pause and a retrospect, we turn—to look forward to the things that are to come.

That all may enjoy peace and happiness is our sincere hope. We add to the chorus our wish for a Merry Christmas and a Happy New Year.

THEY CONTINUE TO SERVE

"The river is rising rapidly at Portsmouth on account of heavy rains in the upper valley. A thirty-five foot stage is expected here by tomorrow."

This bulletin was sent over the rural lines of a telephone company in the Ohio River valley one fine morning after several weeks of fair weather. In twenty-four hours, the river had covered the lowlands, but crops and live stock valued at thousands of dollars had been removed to higher ground because the farmers had been warned in time.

This was only an ordinary incident in the operation of that telephone company; similar incidents occur frequently in the operation of hundreds of other telephone companies. They are so commonplace, in fact, that they scarcely receive notice; yet, attention deserves to be called to them, for they illustrate the value of the telephone and the spirit of service that animates those who operate the exchanges.

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Genius in Lincoln Replacing

New Automatic Equipment Is Installed Without Interfering With Present Equipment—Jacks Raise Old Installation—Big Money Saving Is Effected

By M. T. CASTER

(Plant Superintendent, Lincoln Telephone and Telegraph Company)

One of the laws of physics is that two bodies cannot occupy the same space at the same time. However, it is possible and sometimes practical to approach that condition.

The Lincoln Telephone & Telegraph Company organization found it necessary, because of increased maintenance cost and the demand of its patrons for modern substation apparatus, to replace forty-six hundred lines of 3-wire Strowger automatic equipment in the Main exchange at Lincoln, Nebraska, with modern equipment. The major portion of equipment to be displaced was installed in 1903. The remainder was installed at later dates.

This equipment occupied space approximately 40x60 feet in a room 40x100 feet in size, the remainder of the room being occupied by power machinery and equipment not to be replaced. The main distributing frame was located one floor below and directly beneath the equipment so that any change in location of new equipment would mean additional length of cables between the main distributing frame and the switchboard.

Space could have been secured in a portion of the general office building adjoining the exchange switchboard room by providing elsewhere for offices of operating departments. The estimated cost of this change was $30,000. The space thus made available for switchboard installation would be about fifty feet farther from the main distributing frame. The cost of extra cable and runways would be approximately $12,000, making the total added investment $42,000. Elevator operating cost of approximately $200 per month would also be added on account of placing offices of operating departments on the fourth floor.

The proposed switchboard requires considerably less floor space per one thousand lines than the older type. The saving in floor space which would result from the substitution was sufficient to provide for a growth of fifty per cent if installed in the room occupied by the old equipment and this without appreciable added investment for building.

T. G. Martin, chief engineer, and H. P. Mahoney, superintendent of installation and operating department, of the Automatic Electric Company, which manufactured both the old and the new equipment, suggested the possibility of raising the old equipment to the ceiling of the present equipment room and installing the new equipment on the floor thus vacated. This move seemed rather heroic, and before it was finally adopted considerable investigation was necessary.

The question of floor strength to carry the combined weight of old and new switchboards was carefully checked, and it was determined that the concrete slabs would require reinforcement. This was accomplished by placing beams beneath the floor slabs in such position as to reduce the spans between supporting beams to one-half the original length.

The equipment room varied in ceiling height from 14 feet 4 inches to 18 feet 9½ inches, having a sloping roof with no horizontal ceiling beneath. The portion of the room occupied by equipment, which would be raised to facilitate the installation of new apparatus, varied in height from 15 feet

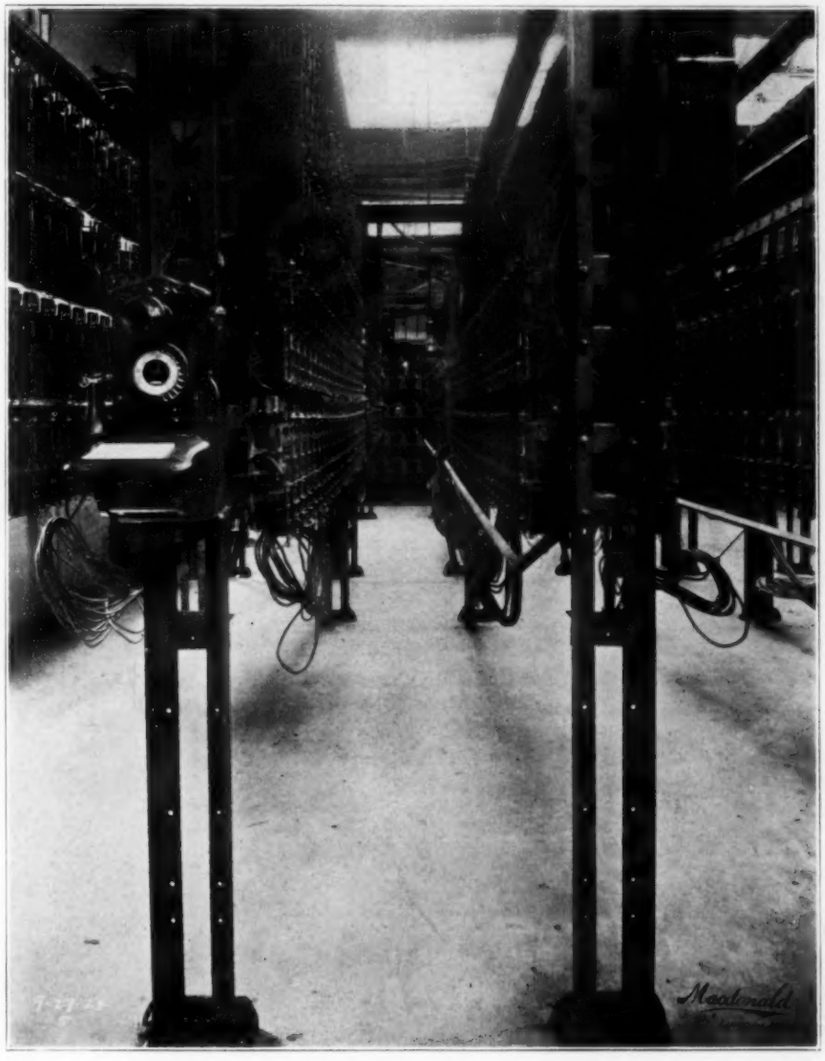


Fig. 1.

5¾ inches at the lowest point to 18 feet 9½ inches at the highest point. The new apparatus measured 9 feet 7 inches to the top of the cable runways. Allowing 5 inches space for placing cables on the runways would require a minimum ceiling height of 10 feet for the installation of new apparatus. Deducting 10 feet from the 15 feet 5¾ inches at the lowest point left only 5 feet 5¾ inches vertical space in which to place the old apparatus; also maintain and operate it during the installation period.

In order to reduce the height of the old equipment to permit its operation, also the placing of a floor, within a space of 5 feet 5¾ inches extensive rearrangement of the switchboards was necessary. This involved raising the two upper shelves of first selector switches ¾ inch and 1½ inches respectively; also removing the two lower shelves of first selectors and transferring them to the back of the switchboard opposite the two upper first selector shelves. This vacated space 39¼ inches in height at the bottom of the switchboards. Rearrangements of power wiring and cable runways on the tops of the switchboards would effect a further reduction of 4¾ inches. With this arrangement of equipment there was exactly 1 inch vertical clearance below the equipment which could be occupied by the floor upon which maintenance forces must work during the installation and cut-over period of the new apparatus.

An inverted floor was then designed, the supporting joists to be installed between the banks of the lower shelves of first selector switches. This spaced the joists 36 inches apart on centers.

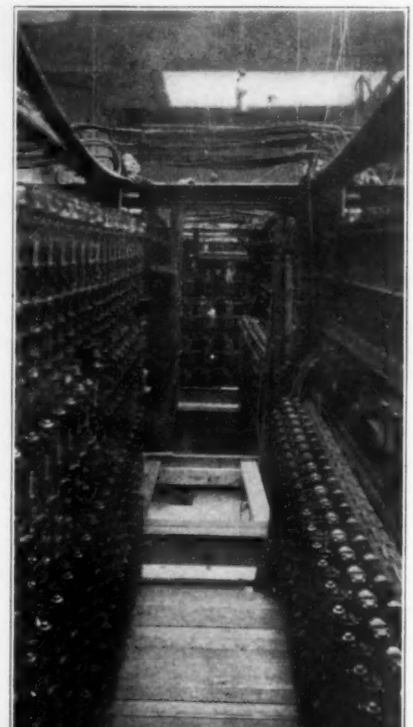


Fig. 2.

Tests showed that two cement-coated nails in each 3 inch floor board would hold them securely attached to the bottom of the joists.

The next problem was securing sufficient cable length between the main distributing frame and the equipment to permit raising it the desired distance. The cable runways between the main frame and the equipment contained two vertical 90 degree bends and one horizontal 90 degree bend. Removing the cables from the runways and supporting them diagonally from the main frame to the cable holes through the floor would provide sufficient slack cable in thirty-four hundred lines. It was therefore necessary to splice additional length into only twelve hundred lines.

Accessibility a Delicate Problem.

The problem of maintaining the apparatus in its raised position during the installation period, which was estimated to extend from October 1, 1924, to May 1, 1925, was also investigated carefully. The clearance between switchboards, which was normally 28½ inches, would be reduced to 20 inches, and first selector switches would occupy both sides of this reduced space where formerly one side had been occupied by switches and the opposite side by frame work against which a person may come in contact without damage to the equipment. The headroom under the cable and power wire runways at the ends of aisles between boards would be reduced to 53¼ inches. The headroom in the aisles between thousands would be reduced to 55¾ inches.

Access to the false floor under the elevated equipment would have to be gained over narrow stairways, one of which could be only 18 inches in width.

After all the questions had been considered and the proposals very carefully checked for possible oversight, the plan was adopted and carried out as follows:

The rearrangement of switches and runways on the switchboards and cables between the main frame and equipment room was accomplished during the three months' period just prior to the raising of the apparatus, at a cost of approximately $2,000, and with no serious interference with service.

The Strowger switchboards were maintained in vertical position and in their original relation to each other during the raising process by bolting 8-inch channel irons 12 feet in length to the vertical angle irons at each end of each 100-line board. These channel irons were spliced end to end across each group of ten boards and attached opposite the lower shelves. They also supported the floor joists above referred to, and the floor in the aisles between the switchboards.

The actual operation of raising the equipment was divided into two jobs; first, a group of six Keith type 3-wire switchboards was elevated and supported and later four thousand lines of Strowger boards were elevated in one group.

Fig. 3.

The raising of the Keith boards was comparatively simple, as they occupied a space of 3x20 feet and weighed only about 2½ tons. The Strowger boards occupied a space 30x50 feet and weighed approximately 52 tons.

In raising the four thousand line group twenty-six house movers' jacks were employed, six being used under each one thousand lines of switchboard, and two under a trunk selector switch bay, which was raised at the same time. Square timbers 6x8 inches were employed for cribbing, the lower timbers of each crib being 8 feet in length so as to span between floor supporting beams, the cribbing above these being from four to six feet in length.

Thirty-eight Men on Job.

The organization consisted of thirty-eight men. Part of these operated the jacks, others brought in cribbing material and built cribs, and the two groups were supervised by two men. A policeman's whistle was used in signalling for the operation of the jacks. When all was in readiness the supervisor gave a blast of the whistle and every man turned the jack in his control one-fourth turn. After each turn wedges were inserted to take up the slack between the cribbing and the apparatus so as to avoid possibility of accident. The equipment was raised at a rate of approximately 9 inches per hour, the entire job being completed between 7:30 morning and 4:45 evening of the same day. After the switchboards were raised to the desired height, vertical supports were placed. These were located in the aisle spaces provided for the new apparatus so as to interfere as little as possible with its installation.

The total cost of raising was $1,600. This included providing and attaching the channel irons and false floor, placing the vertical supports, the use of house movers' jacks and cribbing material; also salaries and wages of all men employed in the raising operation.

The service on the switchboards was interferred with somewhat during the placing of the false floor, due to jarring while nailing the floor boards in place. This loosened some dirt which had accumulated in the banks and other locations in the old apparatus and some of it lodged in contacts which were not protected. During the day in which the floor was placed and the following day in which the equipment was raised the number of cases of switchboard trouble was slightly more than double the normal amount.

Accompanying cuts show the work in progress. Number 1 shows the Strowger boards after the two shelves of first selector switches had been removed from the bottom and placed on the back of the boards.

Fig. 4.

Number 2 shows the boards with a part of the false floor in place.

Number 3 shows the switchboards during the process of raising, with the cribbing and the temporary floor in place, and the ends of the vertical angle iron supports of the switchboards projecting below the false floor. This view shows also the location of the channel irons attached to the switchboards and resting upon the cribbing material.

Number 4 shows the floor from which the switchboards had been raised. The underside of the temporary floor is seen as the ceiling. The vertical supports are also in evidence in this picture. The equipment on the floor in the background is trunk switch and power board equipment which did not require raising. Also in the background can be seen part of the line cables coming through the floor and extending up through the false floor.

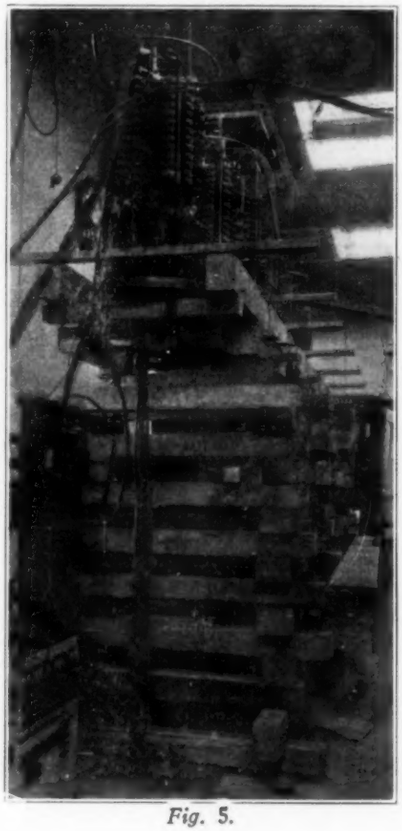


Fig. 5.

Number 5 shows the group of six Keith boards raised and resting on the cribbing. Vertical supports were substituted later.

Maintaining the apparatus in its raised position requires the services of one added employe during each of the three shifts of the day, thus requiring three added employes in the organization.

Cost Comparison

The costs may be summarized and compared as follows:

		Annual charges.
Plan Using Other Space—		
Added building costs	$30,000	
Added cable and runway	12,000	
Total added investment	$42,000	$8,400
Added operating cost, elevator perpetual, month	200	2,400
Total charges per year		$10,800
Plan Raising Old Equipment—		
Rearrangement	$2,000	
Raising	1,600	
Extra maintenance force, 7 months, $375 per month	2,625	
Total expense		$ 6,225
Balance in favor of raising plan, first year		$4,575

Preserving Standing Poles

Method in Use by Western Union Telegraph Company by Charring and Spraying With Creosote Oil—Good Penetration Is Secured and Profitable Increase in Life Is Expected

By P. J. HOWE*

(Construction Engineer, Western Union Telegraph Company)

If man, in general, devoted all of his efforts to building his new industries, his machines, his railroads, his homes, etc., as good and as lasting as he could and spent no thought or effort in keeping his existing plants in shape to operate, his engines to run and his homes to live in, it would not be long before the world would be a pitiful and sorry place for us all. In other words, we must always get the utmost service out of what we have before we discard it for the new. We paint our homes every few years and they last to serve several generations of occupancy. Is there any reason why we should not at least try to make the poles which we already have last as long as possible? Certainly extending the life of the poles that we now have is a task really worth setting ourselves to.

In a way, the solution of our problem looks comparatively simple. There are just three things to be done. First, existing decay must be removed. Second, decay must be stopped and all existing decay and decay germs and organisms killed. Third, further decay must be prevented by making all wood which new decay organisms might reach immune to such decay. How completely these things can be accomplished depends upon the nature of the existing decay and how carefully and thoroughly we do the job.

Most poles require replacement on account of outside decay at the ground line. By the method developed by the Telegraph Company, the writer believes it can be definitely stopped and further decay prevented for a number of years. We call our field treatment the charring and spraying treatment, and after much experimentation and development have begun to use it widely throughout our plant.

Decayed Wood Is Removed Before Charring.

The first step in the treatment of a standing pole is to excavate the earth from around the pole to a depth of a foot or so, depending upon the extent of the decay, and then remove and shave off all decayed wood down to sound timber. The pole should then be allowed to dry out thoroughly for two or three days. Fig. 1 illustrates a pole that has reached this stage of treatment. The next step is to still further dry out the pole and open up all checks and cracks so that there will be little likelihood of further checking, and then to sterilize the wood and kill all remaining decay and its organisms. Fig. 2 shows the process of charring as ordinarily carried on and illustrates fairly well the extent to which the outer layers of wood are charred. The flame is directed particularly into checks and cracks, and finally produces, not only a thoroughly sterilized pole, but a condition of seasoning that will be as complete as will probably ever be reached. It has also produced an outer layer of charcoal which will not only resist decay but will serve a still more useful purpose, as will be explained later.

Creosote Is Sprayed Under Pressure

Immediately after the charring and while the wood is still hot and its cells and contained air and vapors completely expanded, the preservative agent, creosote oil, is applied in the form of a hot, fine, high pressure spray. The spraying outfit consists of a specially designed sprayer, much like a fruit sprayer, except that it is equipped with a special thermometer, spray nozzle, pressure relief valve, etc. The creosote is applied in the manner shown in Fig. 3 under a comparatively high pressure and penetrates far into all cracks and crevices. In fact, the heated condition of the wood greatly facilitates this penetration as the con-

Fig. 1.

**A portion of a paper on "Prolonging the Life of Our Pole Timber" presented at the Annual Meeting of the Telegraph and Telephone Section of the American Railway Association, Quebec, Sept. 9, 10 and 11, 1924.*

traction of the wood cells and the air and vapor in and around them tends to create a vacuum and draw in the oil, just as in the case of the alternate hot and cold bath open tank treatments. This is where the charring above referred to serves its special purpose and contributes to the effectiveness of the treatment. The charcoal is very porous and acts very much like a sponge, taking up an excess of creosote oil and storing it for subsequent absorption in the wood itself. The spraying is continued until the oil no longer enters the pole but runs off to the ground, leaving the pole black and wet with creosote.

The treatment is now finished, but the earth should not be filled in for at least a day or so, or until the oil now held in the charcoal has had time to penetrate further into the wood. Immediate back-filling would cause the excess oil to go into the earth, where its effects would not be beneficial.

Good Penetration Is Obtained

As to the results obtained by the charring and spraying process, it may be said that the penetration is unusually good for a superficial treatment. It must be remembered that as the poles have been in service several years they are invariably well seasoned, and, except for such soil moisture as they may have absorbed, are in ideal condition for treatment. In fact, they take treatment much better than new poles which are not already seasoned. It is not unusual for charring and spraying treatments on old chestnut poles to fully equal open tank treatment on new poles of the same species. Not enough experience has yet been obtained with cedars to permit a definite comparison with open tank treatments, but, as open tank treatments give a much better penetration in cedars than in chestnuts, it is not to be expected that any superficial treatment of short duration can be as good.

Fig. 2.

Fig. 3.

In this discussion of charring and spraying treatments we have been thinking only of old poles, the ones we already have. But mention was made of the many new poles which it will be impracticable to have tank treated and which must be set either without treatment or with a treatment applied at the time of setting. This is where the charring and spraying treatment once more offers possibilities. When the poles are set the earth need not be entirely filled in, and consequently the charring and spraying treatment can be applied very much more cheaply than to old standing poles and quite effectively. The treatment must not

(Concluded on page 42.)

Tell Cost of Growing Pains

Proper Publicity Reconciles Growth and Satisfactory Balance Sheet—What the Public Believes, and How to Show the Light—Rapid Rise in Station Investment

By A. R. BONE*

(General Commercial Superintendent, Illinois Bell Telephone Company)

How are telephone companies to continue to grow and expand at a rate satisfactory to the public they serve and at the same time continue to produce balances of revenues over expenses which will be satisfactory to the investors in the properties devoted to such public service?

A great deal might be said at this point to prove that both objectives outlined in this question are necessary and must be attained; namely, we must expand, year after year, whether we really wish to or not, and we must therefore continue to produce balance sheets which will make possible a continuous inflow of new capital. But we can well admit these facts of our business and devote our time to answering how and when, rather than why, these two most important things should be done.

The simplest answer to the question is merely that rates, which represent our only source of revenue, must be kept at a sufficiently high level. Such an answer, however, is but a platitude with a strong flavor of bromide; it begs the question and leaves us, in every practical sense, as much in the air as ever. We can admit that rates are controlling, but what we want to know is, how can we proceed from now on so as to insure the receipt of proper revenue promptly when needed and without losing the confidence and cordial coöperation of our subscribers, which we know to be essential to the real success of a modern public utility company? The answer to that, of course, is proper, persistent and perpetual publicity as to the facts of our business. Not altogether by any means printed publicity alone, but all kinds of educational information disseminated by word of mouth to small groups and large groups through all of our employes in all departments. Now then, what are some of the facts, and especially the facts which are not obvious or even easily understood by our patrons? Let us consider them from the viewpoint of the patrons to whom, let us assume, we have just announced that a raise in our rates is necessary and will soon be put into effect. The so-called facts which they will raise for our consideration will probably be something as follows:

Rate Raise Kicks Analyzed

"Point 1—The war, we admit, justified your last increase, but it has long since been ended; commodity prices are gradually decreasing; many prices and rates are being lowered, not raised."

"Point 2—Wages, we admit, have not been reduced and we don't think they should be; but, if commodity prices are falling, certainly your costs as a whole must be falling and therefore there can be no justification for higher rates now."

"Point 3—Some utility rates have been reduced instead of raised lately; and if one utility can make reductions they all should be able to do so, insofar as economic considerations are concerned."

"Point 4—You haven't suspended dividends yet, so I guess you don't need any more money in my town; not just yet." (This statement and the erroneous conclusion drawn from it will, of course, be most frequently used in territories where a company is operating many exchanges.)

The list of "points" and "conclusions" drawn from them by the public we serve could be extended, but it is Those enumerated show that we have a real publicity problem to meet and that we now have greater necessity than ever before for explaining the real facts of the telephone business and the true conclusions which they justify. Now what are some of those facts, as seen by those familiar with the actual operation of a telephone company? In general, we will find that the facts are not altogether misstated by our patrons; they do not know all the facts; they do not know the whole story, and therefore it is their conclusions which are incorrect. Our publicity must be so planned and aimed as to convince them of this final and most important fact.

As we know them to be true from our experience and records, the current facts of our business may be stated as follows:

1. Rates must cover the volume or amount of service supplied as well as the unit cost of such service. Every exchange must grow; most of them have grown very rapidly during the past five years. Primarily, and regardless of current price levels, therefore, the average subscriber is being given a constantly increasing volume of service, in the form of longer average circuits or more messages per day, or both. This obviously will necessitate a gradual increase in average revenue per subscriber in a growing city, even at fixed unit costs. In a flat-rate exchange this can be met only by successive increases in basic rate schedules, or higher rates for apparently similar service classifications. The public fully recognizes this principle—it even demands its application—as applied to two exchanges of different size. All commissions and telephone companies do the same. We must merely explain that the same principle applies at different periods in the life of any one growing city or exchange. In other words, rates must not only be higher in a city like Peoria than in the town of Galena, but when either of them grows to twice present population and telephone development, present rates, if now adequate, would then without question be very inadequate.

2. The big factor of daily or yearly cost of giving telephone service is the pay roll. Most telephone companies have to use from 60 to 70 cents out of every dollar of revenue to meet this cost. In this respect the telephone business is different from any other utility business and the reasons for this is the fact that our product consists chiefly of personal service, while other utilities furnish an impersonal service or commodity. Unless wage scales should be reduced materially—and even our subscribers would hesitate to demand or desire this under present economic conditions—there is comparatively little revenue left out of each dollar received from which a decrease in rate could possibly be made (as suggested by points 2 and 3 above) or from which the actual increases in other expenses and annual costs can be paid without an increase in rate, or number of revenue dollars received.

3. Commodity prices of most of the materials and parts making up a telephone plant (cables, pole lines, wire,

**An address read at the Illinois Telephone Association Convention.*

apparatus, etc.) did reach a maximum in either 1920 or 1921, although they are still from 70 to 100 per cent higher than they were in 1914, when the great war started, and much higher than they were in 1918 when it ended.

Where Public Is Ignorant

But—and this is the big fact which the public does *not* understand and which our publicity must emphasize and explain more fully—the average cost and value of the plant in use per telephone has gone up every year since 1914; it is now higher than ever before, and it must continue to increase, rather than noticeably decrease, for some years to come; this being true even if unit prices of materials continue to fall. However, they have risen slightly during the current year.

This fact seems paradoxical to the public and probably will not at first be accepted as true, since it is not true in connection with ordinary retail or wholesale business with which they are more familiar. It is not true of a business having a relatively small fixed investment per customer and a quick turnover of goods bought and soon disposed of at current prices. But it is true of the telephone company, the railroads, and others having large and costly fixed plants. Your books and our books show it is a fact, and its mathematical demonstration is an easy matter.

During the war we all spent as little as possible on plant extensions and used our facilities as fully as possible. As a result (using our large Chicago exchange as an example) our average investment per station increased only 8 per cent up to 1920, which was the year of peak commodity prices. But it has increased more rapidly each year since and now shows an increase of 27 per cent over 1914. And to show that this is not peculiar to city conditions, our average for the entire suburban division, covering eight counties around Chicago, is now 26 per cent above the figures for 1914, practically the same increase as in the case of Chicago.

Of course, the explanation is that the commodity prices, while on the downward trend and noticeably less than three or four years ago, are still far higher than our present average in use; and therefore any additions at present prices will still further raise the average until the two figures cross again, which, as indicated by the chart, will not occur for some time to come.

The carrying charges of this increased investment as well as the increase in taxes, to which we have all been subjected, will have to be paid out of the 30 or 35 cents left of our revenue dollar—after wages are paid. With wages not reduced and other items increased, this remainder is too small.

Now as to our point No. 4—"You haven't suspended dividends yet, so I guess you don't need any more money in my town; not just yet." It is not true that nothing should be done to equalize and adjust rates in one exchange until the company owning that exchange is in financial straits. Such a plan is economically and financially unsound, which means in the case of a public utility that it is against the best interests of the public served and to be served by that utility. As a business proposition it is the same as though the management of a department store paid no attention to each separate department, but continued to sell shoes, or hardware, or hosiery, at a loss until the whole store was in financial trouble. Certainly we should have no difficulty in meeting such an argument in connection with any one situation which develops a local need for increased revenue based on the facts of its present financial standing.

The fact that the value of our service is still far above any price we have so far asked for it, or are likely to be required to ask for it, is the most comforting fact to our stockholders and to us as managers of their properties. We owe it to the public, and to our professional selves, to produce good service at the lowest adequate rates. But if the facts show that we need higher rates we need never fear that we cannot secure those rates due to their being above value and therefore impracticable. We must only show our facts and prove our case. As a matter of fact, there are a great many companies in the state that have had to reduce or pass dividends or pay them out of surplus set aside for deferred maintenance. These companies can look ahead to the time in the near future when, under existing rates, there will be no surplus and dividends will have to be suspended.

Protect Company Entirely

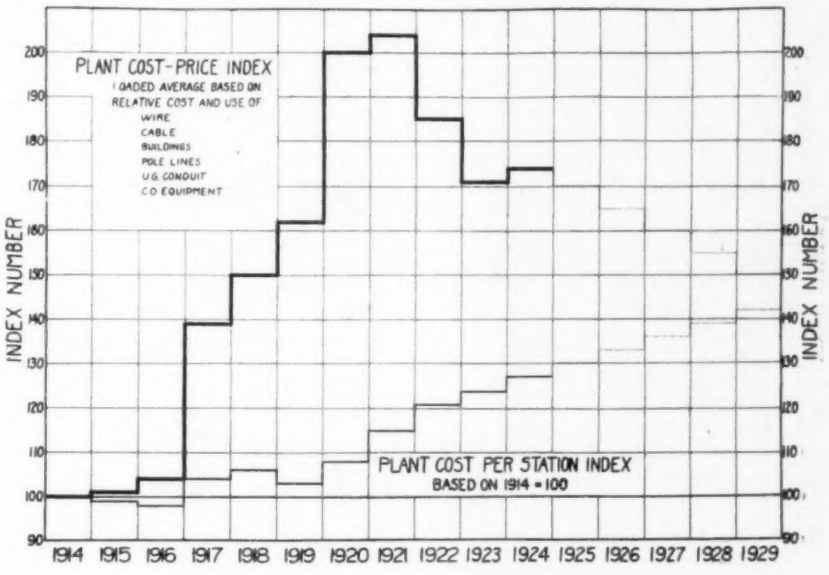
In this connection let me quote from an opinion of Chairman Prendergast of the Public Service Commission of the State of New York, in a recent rate case:

"The provision of the statute regarding the preservation of the property of the company does not refer to its preservation in a physical sense. It means the preservation of its property as a whole, or its corporate interests as a whole. The preservation of the property means that the company will be empowered to make such charges for its services as will enable it to carry on its business without the fear of financial embarrassment, make its plans uninterruptedly for the extension and improvement of its business, and preserve and maintain its credit. All of these considerations are subject to the company being allowed a fair rate of return."

"It must be remembered that the company can never recover losses that it may sustain in this way, and I hold that it is just as immoral to deprive a public utility of its just returns as it would be to knowingly permit a utility to charge a higher rate than that to which it was entitled, and in that way exact from the public tribute that it should not pay."

One more fact which we must not overlook nor fail to state on every occasion is the basic fact of all utility service, that the service itself—its quality, its adequacy, its dependability—is the important thing in all places at all times. Such service must first be given and maintained. The rates for such service are then determined on a fair basis, but as an entirely secondary matter, to fully cover the cost for such good service. This is what the public really wants and we should recognize such real demand even through the smoke screens which are so often thrown up to cloud the real issue. Give the service, satisfy the de-

(Concluded on page 42.)



Pointers on Line Wire Work

Stringing Line Wire Calls for Careful Work that Is Described in Current Installment of Higgins' Series—Data on Common Return System

By P. Kerr Higgins

Where more than one or two wires are necessary, especially when copper wire is used, the stringing of lines must be extremely well and carefully done. In stringing more than two wires, the use of a running board (Fig. 1) has been found to be very convenient and in most cases absolutely necessary. It is important that all the wires be

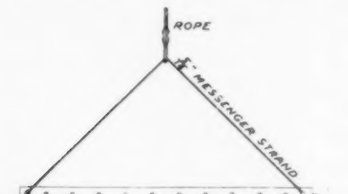


Fig. 1. The Running Board.

drawn as near as possible to the same degree of tautness and a method frequently used is shown in Fig. 2. Wires of the same size should be pulled up with this apparatus. If six wires are being pulled up, a three-sheave block will be necessary. With eight wires a four-sheave block, and with ten wires a five-sheave block. Before the work of stringing the wires is started, the insulators to which the wires are to be attached should be fixed in their proper position on the cross-arm or brackets. Care must be taken to see that the end poles and arms are properly guyed so that they may be held in the proper position.

When the running board is to be used, a rope should be carried over the cross-arms for a distance of from twelve hundred to fifteen hundred feet, and its end fastened through the ring in the center of the running board. The reels with the coils of wire should be placed at the end of the line and one end of each wire fastened to the running board. If mechanical means or horses are used to pull in the wires, they should be started slowly and speed gradually increased as the situation may warrant. On each pole a lineman is required to lift the board and wires over the top of the cross-arm or to guide it around the pole when wire is being strung on lower arms. In the latter case it will be necessary to take off the wires on one side of the running board and fasten them again when the running board has been taken around to the far side of the pole. Suitable snap blocks should be provided so that this work may be done quickly.

When the reels have been emptied, the wire should be fastened temporarily and the process just described repeated until the entire line is strung. The apparatus shown in Fig. 2 is then used for drawing up the wires to the required tautness, allowing the proper sag as indicated in the previous article. Smooth jaw grips should be used to avoid injury to the wire. The wire having been drawn to the proper tension, it should be held in place temporarily by means of a short loop of rope and clamp fastened to the wire near the cross-arm, the loop of the rope being fastened around the insulator pin.

Let me emphasize again the necessity of extreme care in handling copper wire for reasons which have been explained in a previous article. All coils of copper wire should be carefully examined to see that the wire has not been injured in any way during transportation. If injured, then the injured piece should be cut out and not used. If badly injured, the entire coil should be rejected. In stringing wire under all circumstances great care must be exercised to avoid twists and kinks. If the wire becomes kinked the injured portion must be cut out. Otherwise trouble will result later. It is always a difficult matter to string wires direct from the coils; hence a reel should always be used. This rule is imperative in stringing copper wire.

In stringing the wire, the longest lines should be placed on the upper arms and the shorter wires on the lower arms. If one cross-arm only is used, then the longer lines should be on the inside and the shorter lines on the outside of the arm. On existing lines, transferring may be necessary, but it is advisable on account of convenience of tracing the wires later and it also improves the appearance of the line. As a general rule the outer pins should not be used until the inner pins have been fully occupied. Wires must retain the same relative position on pins and cross-arms throughout their entire course and must not jump from one set of pins to another on the same or adjacent poles. The only exception to this rule is where transpositions are necessary.

In stringing single wires the following hints, taken from a pamphlet by Mr. H. N. Faris of the Kellogg Switchboard Supply Company, may be of some use: "Dead end the wire at the starting point, not on a bracket nailed on the side of the pole, but by passing the wire around the entire pole,

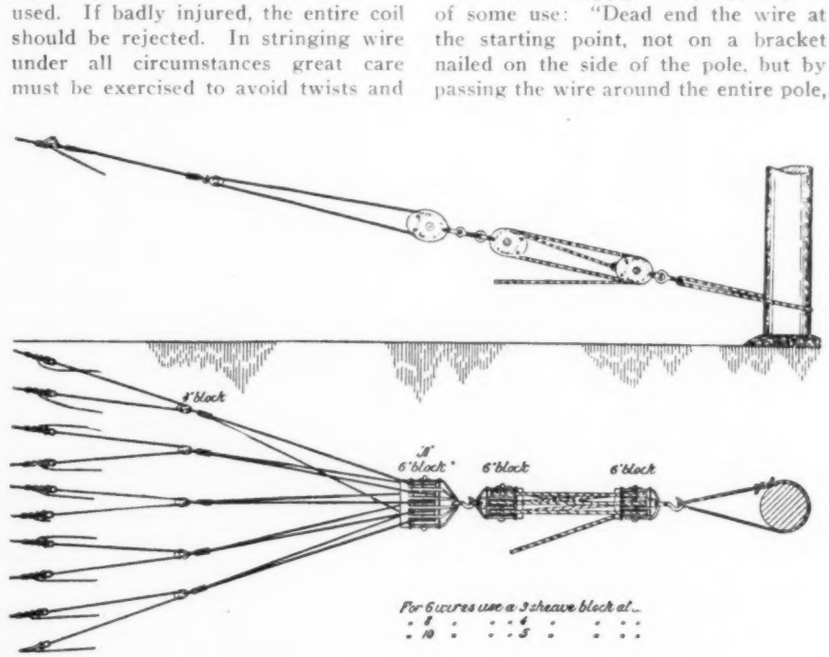


Fig. 2. Apparatus for Pulling Up Wires.

using a circuit breaker or not less than four brackets nailed on backwards in a circle around the pole. Leave the lineman at the foot of the second pole, where he is to remain until at least a half-mile straight stretch has been strung along the ground at the foot of the poles. Pull to the furthest pole the wire will reach, dead end and throw the fractional span which is left into the wagon and it may be cut into tie wires. Take end of new coil and make a half connection to the tight wire and reel off another half-mile coil and proceed as before. Meanwhile the lineman will have started carrying up and tying in the tight wire. If the spans are reasonably short, he will not attempt to tie in at the last pole, but will come ahead to the dead end and wait until the wire is pulled ahead. He then cuts the dead end loose from the pole, finishes the half connection and resumes tying in where he left off." The same method is used for stringing two bracket lines except that two men are used for tying in. This method is very convenient in stringing rural lines in territory where the right of way is clear of trees and other obstructions.

When lines must be carried through trees that cannot be cleared or trimmed to permit a clear passage for the wires, tree wire with suitable insulation should be used. This insulation consists of 3/32 in. rubber covered, taped and with two braids over all. Where tree wire is used, if there is danger of abrasion from limbs or large branches, it should be suitably protected. The clear space between the crown of the road and wires crossing same should always conform to requirements in that neighborhood, but in no case should it be less than twenty-one feet and should clear all guy and other wires by not less than twenty inches except where they are rigidly attached to poles.

Splicing Telephone Wires

The writer is tempted to state that the splicing of telephone wires is the most important part in the stringing, notwithstanding the importance of avoiding kinks and injury. The reason is apparent since trouble due to negligence in stringing the wires will develop very quickly and is comparatively easily remedied, while trouble due to carelessness and negligence in the proper splicing of wires does not appear immediately and when it does appear is expensive and difficult to locate. Perhaps more trouble today in the smaller exchanges and rural lines is due to poor splicing than any other single defect.

The writer was called to locate some trouble recently in a small exchange and after locating the actual trouble, the line being almost open, he made a voltmeter test of all the lines in that exchange, the result being that 86 per cent of the lines showed high resistance joints. A list of these was made up and given to the manager with detailed instructions how to run them down with the use of a Pignolet voltmeter, a method which was fully explained in TELEPHONE ENGINEER, Vol. 28, No. 3, February, 1924. Another visit was made nearly a month later, but notwithstanding the efforts of the writer to impress upon the manager the importance of having these troubles cleaned up, only three lines had been fixed and these in town where they were easy to get at. The laziness of some small exchange managers and

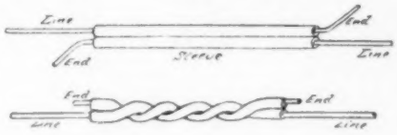


Fig. 3.

their unwillingness to think and study out their problems is appalling and a source of great expense to the owners and annoyance to the patrons. Expensive instruments, tools and every convenience are provided for such men by the companies, but it seems that some of the men are interested only in loitering around the streets waiting for quitting time and pay day.

Copper and iron wire cannot be treated in the same manner as regards splicing. In the case of copper wire, the splice is universally made with what is known as "the McIntyre sleeve" (Fig. 3), which consists of two copper tubes welded together, of the proper dimensions to fit the required wire. The following table gives the size, diameter and number of twists of the different gauges. The writer hesitates to recommend the use of iron sleeves for iron wire, solely because the risk that they will not properly be made up is very much greater than in the case of copper wire. Moisture gets into the sleeve and the lack of uniformity in the metal sleeve and wire sets up electrolytic action which produces corrosion and consequently a high resistance joint.

No. 10 BWG iron has a diameter of .134, while No. 12 has a diameter of .109 and No. 14 has a diameter of .083. In the case of iron sleeves, it is best to give them an extra half turn.

It is the experience of the writer that it is well to use a separate clamp for copper wire splicing only. These clamps come in two types, one having four round holes (Fig. 4a) suitable for twisting bare wires, including copper wire Nos. 6, 8, 10, 12 B. & S., and iron wire Nos. 8, 10, 12, 14 BWG. The reverse side has openings for twisting double tube sleeves, thus making a combination clamp. The side for double tube sleeves fit copper sleeves Nos. 8, 10, 12, 14 and 17 B. & S., or iron sleeves Nos. 10, 12, 14, 16, 19 BWG. This size of clamp is known as the 9

Fig. 4-A.

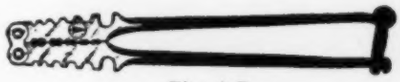


Fig. 4-B.

in. The other type (Fig. 4b), known as the 11¼ in., is provided with five round holes for twisting bare wire and an oval opening for guy or messenger strand. This size fits copper wire Nos. 4, 6, 8, 10, 12 B. & S., or iron wire Nos. 6, 8, 10, 12, 14 BWG. The strand opening is .467 x .624 in. The reverse side has five chambers for twisting double tube sleeves, as follows: Copper sleeves Nos. 6, 8, 10, 12, 14 and 17 B. & S., iron sleeves Nos. 8, 10, 12. 14, 16, 19 BWG. This type of clamp is very hard to beat for all around telephone splicing.

In Fig. 5 is shown a common source of trouble, not only developing high resistance due to corroding when under tension, but also develops a very bad cut out. While the work of making these joints has been usually laid

Fig. 5. "Hook" or "Baling Wire" Connection. A Common Enemy of Service.

to the farmer, the writer has found that many of them are the work of careless, indifferent or inexperienced linemen.

In splicing iron wire without sleeves two methods are used, namely, the American or Western Union joint, shown in Fig. 6, and the three-wire joint shown in Fig. 7. The three-wire joint makes a very fine connection when properly made, but very few linemen like to make it because it means extra work for them. Either

COMPARATIVE TABLE FOR STANDARD SLEEVES

	B & S Copper		N.B.S.Copper.		
No.	Diam.	No. of turns	No.	Diam.	No. of turns
10	.102	3	12	.104	3
12	.081	3	14	.080	3
14	.064	4	..	....	..
17	.045	4	17	.045	4
18	.040	4	..	....	..

No. 9 and larger takes 3½ turns.

type is satisfactory if properly made. Preferably the center or "neck" of the splice should be soldered in order to insure a perfect connection. A splice having a shorter neck is sometimes used, but the writer prefers the splice shown in Fig. 6, as the tendency to pull together under strain is not so great and examination from the road for high resistance joints is much easier than in the case of the short joint.

Iron, though bright when new, soon rusts when exposed to the elements. If two bright iron surfaces be firmly clamped together, so as to make it as nearly air and moisture proof as possible, the contact thus made will remain bright for a long time. Pressure therefore is important in good splicing.

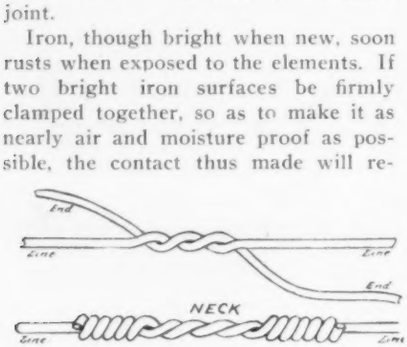


Fig. 6.

The method of making the three-wire splice is not understood by many linemen, so that the following may be useful: Place a piece of wire twelve inches long alongside and parallel with the other ends, then place the connectors about three inches from one end and wrap both free ends around the line wire. The connectors are then placed at the other end of the splice and the remaining two ends wrapped around the line wire. The connectors are then placed on the wrapped ends and the splice is firmly twisted with a pair of pliers placed lengthwise with a splice at the opposite end.

Some linemen wrap tinfoil around their joints. The writer believes that this will not do any harm but cannot see that it has any real value. All wires should be thoroughly cleaned before being spliced together; otherwise defective joints will surely result. In the case of copper wire emery cloth should be used, as scraping the copper wire destroys its tensile strength. Do not forget that high resistance joints not only affect transmission but are frequently the cause of an unbalanced metallic circuit line. Especially is this true where phantom circuits are used which require as nearly a perfect balance as is possible to obtain. Bad splices also affect the calculations of wire chiefs who are trying to locate trouble and their tests are governed by the conductivity of the line under normal conditions. If a high resistance joint exists and he does not know it, his location of the trouble will be misleading. Results of exhaustive tests of splices made by C. T. Rashman have been reported in the Electrical World. These results were also published some time ago in TELEPHONE ENGINEER. They tend to prove that the important part of an iron splice was the neck and that not less than five properly made turns should be used at this point in the splice. Fig. 8 shows different splices used in these tests. That indicated in No. 5 is considered the most efficient splice. The tension at failure as shown by these tests is given in the following table:

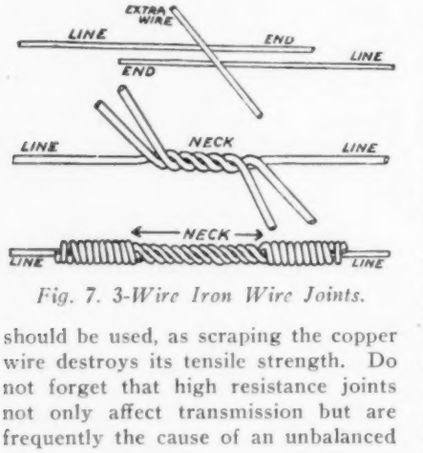


Fig. 7. 3-Wire Iron Wire Joints.

Turns in Neck.	Failure Tension Lbs.	Cause.
3	230	Splice slipped.
4	230	Splice slipped.
5	475	Wire broke outside of splice.
6	475	Wire broke outside of splice.

Common Return System

On a recent trip west the writer in succession visited three exchanges which are still using the common return system, but the men operating the exchanges did not seem to understand the technicalities of that system. Although this system has been obsolete for many years, there are still a large number of exchanges using it. Therefore some discussion of it may not be out of place in order that best results may be obtained from its use until such time as it is replaced by the full metallic system. It must be understood, however, that the writer is not recommending the system for use in this modern day and age.

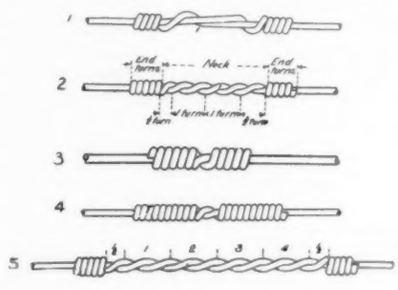


Fig. 8.

To those who are familiar with the early history of telephony, it will be remembered that originally all telephone lines were single wire circuits (known as grounded circuits) and the practice of using earth return continued for many years. With the advent of electric light and street car service and later the high tension lines, grounded circuits are now almost in the discard except in the rural districts. Even there, it is only a matter of a few years until they will have to be abandoned, due to the linking up of small cities by the high tension lines. On account of the cheapness of the grounded circuit service, many people were willing to put up with the cross-talk, but the inductive interference from the high tension lines develops a peculiar hum and noise on these circuits which makes their use absolutely impossible. As a happy medium between the grounded circuit and the metallic circuit service, the common return was devised and developed by a Mr. McCluer of Richmond, Va., many years ago and it is still in use in many communities. While it eliminates the cross-talk, to a large extent, it is a question if the expense of installation of such a system is justified where inductive interference from high tension lines exists.

The common return system provides for each main and branch pole line of the telephone exchange, a copper return wire to which the telephones of that neighborhood are connected, instead of using ground rods, as in the grounded circuit system. If only a few telephones are connected to a common return wire, the cross-talk and inductive interference is considerable, while if enough telephones connected up even a break in the return wire would not result in cross rings or any appreciable amount of interference. This is due to the fact that when only a few telephones are connected to a common return, the current which does not return by the return wire leaks through the other telephones and produces cross ringing or cross talk. When a large number of telephones are connected using the common return the current divides itself up into such small parts that no leakage is perceptible.

The return wire should be kept thoroughly insulated in order to get as near the metallic effect as possible. The chief disadvantage in such a system is the lack of similarity between the two sides of the line, one being the actual line wire and the other wire common to all the subscribers. A metallic circuit gives a complete balance of the subscriber's line and renders it free from cross-talk, cross ringing and inductive noises.

Naturally the question of the size of wire which should be used in a common return system is extremely important. It has therefore been customary to calculate the gauge of the wire by the resistance it should have from the center of distribution to the common meeting point at the central office. This is based on the assump-

tion that the preventable cross-talk is due to the resistance of the common return. By making this low enough a maximum degree of immunity can be obtained from stray currents. However, it must be clearly understood that it is almost impossible to avoid the cross-talk caused by magnetic and static induction between wires. Even metallic circuits have been known to cross-talk quite badly until transposed so as to make the exposure uniform throughout the entire circuit. Two rules are in common use for computing the resistance of the common return.

1. Let

R = resistance of the common return.

R^1 = average resistance of a line including drop, bell and line wire.

N = number of lines in the lead.

n = number of lines likely to be in use at any one time; 15% may be used for this purpose.

Then

$$R = \frac{R^1}{N - n}$$

The above formula makes the common return have a resistance equal to the assumed joint resistance of all the lines not in use.

2. Let

R = resistance of common return.

R^1 = resistance of average line, including drop, bell and line wire.

N = number of lines in the lead.

Then

$$R = \frac{R^1}{N}$$

This formula makes the common return have a resistance equal to the joint resistance of all the lines cared for by the return wire.

Another formula which has found some favor is as follows:

$$Rc = \frac{Rd + Rr + R1}{Rn}$$

Rc = resistance of copper wire for the average length of the line wires.

Rd = resistance of the drop.

Rr = resistance of the ringer.

R1 = resistance of the line (average).

Rn = number of lines on a lead of poles.

Many manufacturers are now eliminating a good deal of cross-talk on common return system by winding the drop coils to a higher resistance, say 500 ohms and using ringers at the sub-stations to correspond with this resistance. This tends to keep the return current to the return wire where it belongs or at least distribute it uniformly among the lines.

While the above methods give fairly good results under certain conditions, they are not entirely accurate. It is apparent that the smaller the number of lines on any return the higher the resistance of the common return. In other words the efficiency of any common return wire varies with the number of stations using it. At first though it would appear that the more lines connected the more leakage paths there would be to assist the return wire to perform its work; hence a smaller sized wire might be used. However, experiment and practice show us that for a lead of 500 lines or under, this effect will be negligible. We may therefore conclude that for small plants the resistance of the common return wire should be in the neighborhood of one ohm, regardless of the number of lines in the lead.

Where cable is available, the line should be metallic through the cable and the common return should be connected to the lines at that point. This is done by connecting one side of the cable pair to the bus bar of the common return and the other side of the line to the line proper. This method permits the common return leads being kept separate, which has been found to reduce inductive effects. Furthermore, it permits metallic circuit service being given to subscribers desiring it. It is well to remember that wires are very superior to the earth. As conductors of electricity the lines are thrown out of balance if the common return is grounded instead of insulated, as it should be. The separation of the common return leads as above indicated has a tendency to confine the inductive interference to its own lead.

Telephone Selling Facilities Erie Building Feature

Erie, Pa.—One of the interesting details of the new $250,000 home of the Mutual Telephone Co., upon which construction will begin soon, will be several rooms devoted to the use of traveling salesmen who want to cover trade in surrounding towns by telephone.

Taylorville, Ill.—Ed. Purcell has been appointed general manager of the Consolidated Telephone companies. Jack Finley, for many years with the Hillsboro Telephone Co., has been made Consolidated's superintendent of lines.

Indiana Bell Mobilizes Ballot Patriots

Indianapolis, Ind.—On election day each Indiana Bell operator in answering a call said first: "Don't forget to vote today," or, "Have you voted?"

Jack Frost on Warpath Opens Season at Glasgow, Mont.

Glasgow, Mont.—First snow storm loss of the season fell to the lot of the Glasgow plant of the Mountain States. Repair expense was approximately $3,000.

China Busy With New Telephone Projects

Shanghai, China.—Changchun (Kirin province) authorities have begun construction of telephone lines to cost approximately $240,000. The Shanghai-Nanking Railway is planning to install a complete telephone train dispatching system.

Monongahela, Pa.—Frank B. Burwell, for 18 years in charge of the Monongahela district, has been transferred to the Warren territory.

Ruthton, Minn.—Folstad Brothers have bought the Holland Telephone Co.

Carruthersville, Mo.—Southwestern Bell plans extensive improvements in the local telephone plant.

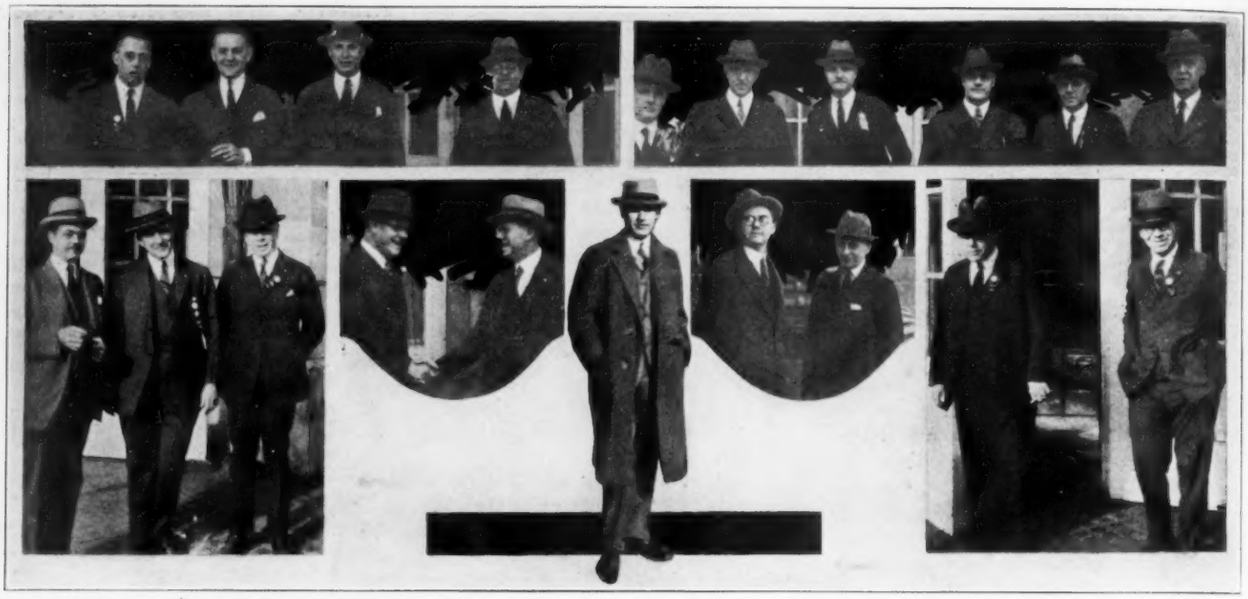
Aline, Okla.—Mrs. R. A. Wright of Cement has bought the local telephone plant.

OUR LITERARY DIGEST

Review of Recent Publications on the Telephone and Allied Subjects

Interior Wall Decoration, by F. N. Vanderwalker, Editor "American Painter and Decorator"

This new volume of 450 pages describes and illustrates all the different methods of finishing interior walls. It gives explicit directions as to how the various effects may be obtained, what materials and implements should be used, time and cost factors, etc. Spatter work, Color Stippling, Glaze Colors, Tiffany Effects, Plaster Staining, Sand Float, Sponge Stipple, Spanish Palm Finish, Roman Travertine, Old English, Holland, French Caen Stone, Italian Plaster and other artistic rough textures are treated in full. Other chapters are on Painting, Calcimining, Preparing Surfaces and Hanging Wall Fabrics.



Norris New Illini Chief

Monmouth Man Succeeds Dr. Gordon at Big Meet

Peoria, Ill.—Back to his plant, his practice and his posies went Dr. H. E. Gordon from the annual convention of the Illinois Telephone Association with a sigh of relief, if that gentleman of so many diversified activities ever has time to sigh. For the El Paso financier and horticulturist at the biggest state meeting Illinois ever had concluded his succession of elections to the leadership of the association, with the election of Fred A. Norris of Monmouth, who was named president for the coming twelve months.

Almost 500, including 176 operators, were registered at Peoria, and this big attendance, together with a notable array of exhibits, made the affair one of the big time events of the year in telephone circles.

During the Gordon administration the Illinois association has made great progress, now being in a position of financial strength and very actively and definitely serving the many members who are coöperating in its advancement.

Plant Service Planned.

Further extension of the Illinois association's work was indicated in the Gordon presidential address, as Dr. Gordon recommended the employment by the association of traveling cable and plant repairmen, who can come into the plants of the association's members and be of assistance in bettering the toll service. Keeping toll service up to a high standard, Dr. Gordon impressed upon the convention, was one of the Independents' vital jobs.

A record of the association's work was presented by its secretary-treasurer, Jay G. Mitchell, whose efforts have been very largely responsible for the Illinois program of member service being fulfilled. High spots in this report were details of the success of the association's service department's operation in bettering handling of traffic and getting favorable publicity for telephone companies, the results of the operators' handbook, and the association's work with the Illinois Commerce Commission. Particular attention has been given by the association's headquarters staff to inductive interference cases.

The association's program for 1925, according to Mr. Mitchell's report, calls for continuation of the usual monthly district conferences and traffic schools, joint meetings with local civic bodies whenever possible, and an aggressive good-will development campaign.

Approximately 96% of the telephone plant investment of the state is represented in the association's membership. Mr. Mitchell credited A. R. Patterson, who was re-elected as the association's vice-president, with being the one who brought the membership up so near to the saturation point. Mr. Patterson is chairman of the association's membership committee.

Fred High of Chicago spoke on "Making Service Pay" and cited instances of team-work that had lifted communities out of mediocrity.

"The letter with a smile wins," Frank Bohn of Fort Wayne advised the conventioners, in speaking on building good will through correspondence. Mr. Bohn said that the letter was too frequently neglected by telephone companies that had made much of every other means in building up cordial appreciation from the public.

He admitted that there are times when a letter must be exceedingly plain and to the point, but that courtesy and tact, even under these aggravating circumstances, should shine out in the company's correspondence. He drew attention to the distinction between courtesy and servility in letters, and gave many practical pointers for the guidance of telephone companies in properly handling its letter contacts with the public.

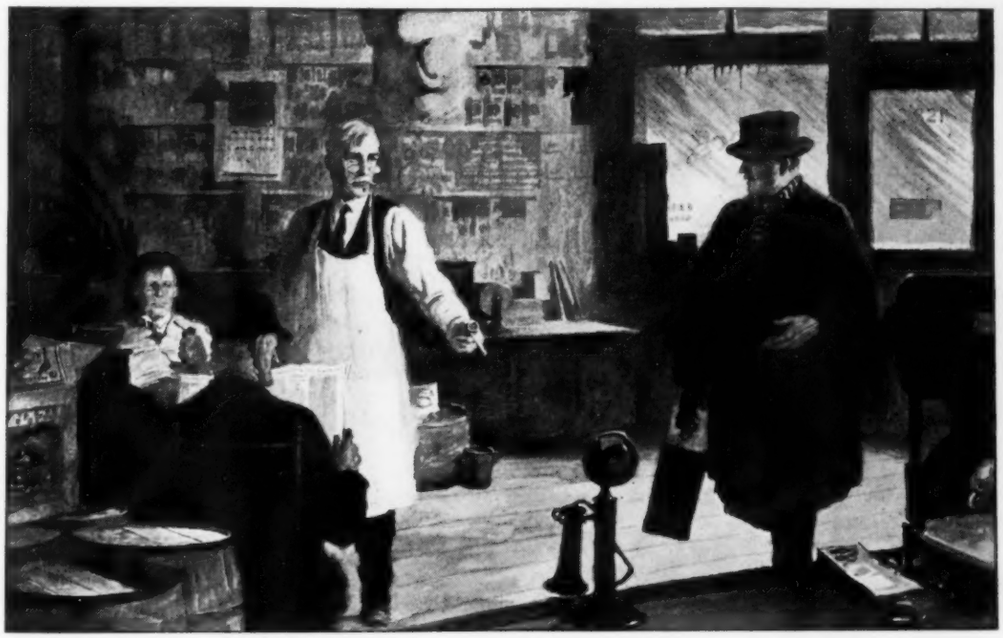
Details of the national association's work were given by the U. S. I. T. A. secretary, C. C. Deering. Mr. Deering, in speaking on rates, stressed the wisdom of a telephone company that had been successful in getting its rates raised, helping its neighbors in putting through a justifiable increase.

Dean Charles M. Thompson of the University of Illinois, College of Commerce and Business Administration, reported on the year's work of the public utility management course.

One of the convention features was the paper of A. R. Bone, commercial superintendent of the Illinois Bell, on "How Can Growth and Satisfactory Balance Sheets Be Maintained?" This address is printed elsewhere in this issue.

"Why an Overhead Construction Order?", an address which outlined the Illinois Commerce Commission's ideas on proper construction, was delivered at the convention by J. Howard Matthews, assistant chief engineer for the commission. This paper also appears in this issue of TELEPHONE ENGINEER.

(Concluded on page 37.)



The People's Telephone

The telephone knows no favorites. It does the bidding of the country store and of the city bank. It is found in the ranch house kitchen and in the drawing-room of the city mansion. Its wires penetrate the northern forest, stretch across the prairie, are tunneled under city streets.

The telephone knows no favorites. Its service to all the people is of the same high standard—the Bell System standard. Twenty-four hours a day it carries the voices of all. For the benefit of all, the long-distance circuits are kept in tune. Numberless discoveries and improvements developed by the Bell System have made the telephone more useful for all the people. In America, all can afford the telephone, for Bell System service is the cheapest, as well as the best, in the world.

The telephone knows no favorites. It is not owned in any one locality or by any particular group of men. It is owned by 350,000 stockholders, who represent a cross-section of the thrift of the whole country. The owners of the telephone are those it serves.

In America to-day the 15,000,000 telephones of the Bell System contribute to the security, happiness and efficiency of all the people.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES
BELL SYSTEM
One Policy, One System, Universal Service

Define Construction Rules

Illinois Commission Proposes Construction Rules in General Order 115—Tells Purpose of Rules and Cites Reason for Supplementing and Revising Order

By J. HOWARD MATTHEWS*
(Assistant Chief Engineer, Illinois Commerce Commission)

Generally speaking, the primary purpose of a set of construction rules is to bring about the highest possible grade of construction consistent with its cost and benefit to the public. Clearances, strength requirements, etc., are proper when they insure adequate safety and service and at the same time incur no unnecessary expense. Too little clearance or inadequate strength constitutes a hazard; too much places an unnecessary burden upon the public using the commodity. Specifically, then, the main purposes of a set of construction rules are:

1—To promote safety:

(a) By prevention of hazards resulting from failures of physical property (such as accidents from contact with charged conductors or low wires over tracks; striking leaning or broken poles, etc.).

(b) By prevention of service failures which may affect safety of human life and property (such as failure of electric supply or of communication means in emergency).

2—To insure reasonably reliable service:

(Attendant conditions, such as importance of service and amount of investment may determine what "reasonably reliable" service is, but certain minimum requirements should be met to the end that the public may be served without undue economic loss or inconvenience due to service failures.)

3—To improve coöperative relations between utilities:

(Notices in advance of construction to those utilities likely to be affected, and an exchange of pertinent information tend to prevent the development of undesirable conditions arising out of failure of one to give consideration to the rights of another.)

4—To serve as a guide to practice:

(While minimum requirements only are set forth, compliance with them will insure reasonable safety and service. They should operate to prevent construction which a good authority would disapprove.)

5—To encourage uniformity in construction:

(a) Within properties (since uniformity makes for efficiency).

(b) Between properties in different states (thereby promoting economic advantages that always follow standardization and adding to the convenience of those building in different states).

In the formulation of a set of rules of this kind there is a need on one hand that they be comprehensive, in that all possible conditions should theoretically be covered; on the other hand, considerable may be lost by making rules so complex as to be difficult of understanding. Instructions of this kind should be such that they can be used by the line constructing company throughout its organization as a guide to proper construction. The contractor or the line foreman, the designer, the engineer and the farmer ought all to be able to understand their meaning and their application.

When any individual, association, or corporation, or any other agency desires information relative to procedure in line construction and relative to the type of construction to be employed, it is well to have a set of rules in a form which may be put into their hands, knowing that a reasonable study of the rules will insure a safe and serviceable type of construction and a safeguarding of the interests of the other public utilities already in the field. We have tried to meet these demands in the proposed rules.

Why New Rules?

A number of years ago the Illinois Commerce Commission adopted a set of rules for overhead electrical construction, known as General Order 30. These rules have performed an important work and have had the effect of materially improving line conditions. They have now become outgrown or obsolete in many respects and experience in applying them has shown wherein improvements should be made.

We felt, and still feel, that at the time of its promulgation, General Order 30 was a very creditable set of rules, but as the arts and practices of telephony and electrical development advanced there also developed a demand for parallel progress in requirements relating thereto. Present-day development calls for more attention to clearances and strength requirements than has heretofore been given.

With these factors in mind, and in the light of greater experience, we have felt for some time that the existing rules covering this subject are in need of revision, particularly in that:

(1) The rules are not complete; they omit a great many minor points which are met with continually. In certain cases where the rules ought to be specific in themselves, the decision of the commission is necessary to determine the character of construction required.

(2) The rules are indefinite where relating to less than 5,000 volts in that it is not clear what the required application of the National Electrical Safety Code to such crossings might imply.

(3) Classes A and B, as defined in General Order 30, appear to be entirely different from any classification given in any other set of construction rules. This results in confusion, particularly where an organization is doing work in more than one state.

(4) General Order 30 considers only different degrees of hazards for different voltages and not different densities of population. There are but two general voltage classifications for determining hazards, classifications for purpose of clearances differing in each section. There is no apparent reason for this lack of uniformity.

(5) General Order 30 limits spans at crossing for both supply and signal lines, regardless of loading strength requirements, etc. Frequently long span construction may be more stable than short span construction and the proposed rules recognize this.

(6) The kind of guys permitted at railroad crossings and where supply lines cross signal lines would be entirely inadequate for many conditions of loading.

(7) Elaborate detailed specifications are given for identifying structures. It is proposed to modify these in an effort to secure the same results at less expense.

(8) General Order 30 contains no unit fibre stresses or factors of safety for wood pole construction. This is a very important item of line design and is fully covered in the proposed rules.

(9) Rules relative to the grounding of circuits are indefinite and have been misinterpreted.

(10) Many references are made to the National Electrical Safety Code, particularly for loading conditions and for determining the acceptability of crossings. The proposed rules will be complete in themselves and carry definite requirements which, under the present rules, are impossible or very difficult to apply.

(11) No consideration is given in General Order 30 to the necessity for increased separation between conductors with large sags.

(12) Specific clearances and strength requirements are fixed regardless of such conditions as density of traffic, loading of lines, character of lines crossed, etc.

(13) General Order 30 does not specify clearances between supply and sig-

**Illinois Telephone Convention address.*

SUTTLE is now in the new home at LAWRENCEVILLE, ILL.

Suttle Equipment Co.'s business so far outgrew its original location at Olney, Ill., that we just had to move.

So we built our own building at Lawrenceville, Ill., and made it an ideal plant for rebuilding and storage of telephone and electrical apparatus, and for printing of telephone forms.

Now we're getting straightened away after moving, and are all set to make a bright new chapter in the history of the Suttle Equipment Co.'s steady development.

You know how we have served and grown. Not long ago, a small shop that bought used telephone equipment and skillfully rebuilt it so its service and appearance was practically that of new apparatus. Often, we bought the entire equipment of a plant that was in a consolidation.

Telephone men soon learned that the Suttle Equipment Co. was the place to come for bargains in rebuilt equipment, for there they always got just what they wanted.

Then our business in printing standardized telephone forms started, and that, too, grew swiftly because quantity production and an intimate acquaintance with telephone company needs qualified us to make buyers the most interesting propositions.

With our fine new plant, laid out ideally for our work, and big enough to give us the space we need for a continuously growing business, we can serve you better than ever before.

Ask us for Suttle rebuilt bargains, and always get the Suttle samples and quotations on your printed form requirements.

SUTTLE EQUIPMENT COMPANY
401, 403, 405 NORTH FIFTEENTH STREET
LAWRENCEVILLE, ILLINOIS

nal lines in cases of overbuilds or conflicts.

(14) General Order 30 contains no rules discouraging the overbuilding of signal circuits by power lines.

(15) General rules are given in General Order 30 where inductive influence is considered likely with a statement of permissible parallels for given voltages, separations, etc. These rules have been used, or possibly misused, where as a matter of fact they were not properly applicable. Sufficient studies have not yet been made to warrant the adoption of the values contained in that rule.

(16) Grounding of metal poles and metal arms on wooden poles is required at crossings without extra insulation. This probably increases the liability of failure at the crossing. Such a rule clearly should be modified and that has been done in the proposed rules.

(17) Guys are required on all crossing poles. No omission is permitted where poles are strong enough otherwise, or inside of angles or when crossing at points where guying is difficult or impossible.

(18) Rules of General Order 30 contain some ambiguities, some obsolete and unreasonable requirements, and in many cases call for interpretation of their intended meaning. This permits various interpretations as each individual puts his own construction on the rules.

(19) In the interest of standardization and national uniformity there is a need for revision in order to make the rules correspond more closely with those adopted nationally and generally in effect in other states where revisions have recently been made.

One of the objects of the new rules is to make definite and concrete statements of adequate construction requirements. In the past lines have been built largely on the basis of what was considered general practice. Definite construction specifications were practically unknown. A good many lines were built along the line of what the company had found to be justifiable from experience, or on the basis of the lineman's practical knowledge of what constituted a good line. Many of these lines were well built, some were not. In trying to apply this practical knowledge to new conditions, heavier leads, longer spans, and smaller poles, mistakes were made by wire-using companies and sometimes serious mistakes.

The particular rules now under consideration are quite specific in all points of clearances, strength, etc., and will, in a measure at least, provide instructions for building lines where specifications are lacking. Sight must not be lost, however, of the fact that these rules provide minimum requirements only and, in looking for requirements to meet average good practice, something better may be justified.

Hazards are provided against by grades of construction, depending upon the importance of safety and the likelihood of hazard. The rules will be much more definite on this than were the old rules, particularly in rural districts. Poor construction and maintenance of electric and telephone lines have been found to cause a great deal of trouble on telephone lines, resulting in seriously impaired service.

The new rules will make more thorough maintenance mandatory and, by serving as a guide to minimum requirements, will give the construction man a much better idea of what kinds of construction are required to meet good practice.

The rules are quite definite in specifying the kinds of loads which will serve as a basis for strength requirements. In order to obviate the necessity of making calculations, tables are provided which show the size of poles which are necessary to meet the given strength requirements.

A section has been provided covering conflicting lines, a matter which is not covered in the present rules. This will probably prevent most of the overbuilds which have been one of the most objectionable features where electric and telephone lines are on the same highway. Proper notice is required.

The rules go into considerable detail relative to grades of construction, loading, strength requirements, pole sizes, etc., at crossings. Under certain conditions, at least, these should provide greater protection to the signal circuits crossed.

Among other things, the rules contemplate elimination of overbuilding; that is, except at crossings the conductors of one line should not overhang those of another. A number of conditions of this kind have been found in practice and it is believed that the rules will tend to prevent a recurrence of such conditions.

In order to meet reasonable service needs of the public, all supply and signal circuits should be located, constructed, operated and maintained in conformity with general coördinated methods which maintain due regard to safety, service, and the prevention of interference with the rendering of any other service. Advance notices and required coöperation tend to bring about these desirable conditions.

The time to cure undesirable conditions resulting from conflicts is before the development. Prevention is less costly than the cure. Proper kinds of rules in the hands of parties contemplating construction will operate to this end. A serious economic loss is likely to result from failure to give proper attention to these matters before the conflicting conditions have developed.

Throughout the rules, coöperation and coördination are made mandatory. Though not always apparent, there are advantages to be gained by the signal company's notifying the electric utility in case it expects to do some new building or reconstruction work in proximity to the latter's lines.

The telephone man may very well argue that the existence of his line in the proximity of an electric line cannot interfere with the latter, and for that reason he can see no occasion for sending a notice. It may be, however, that the electric company has in mind some program, the carrying out of which may result in serious inconvenience to the telephone company which would not have resulted had the telephone company's program been known and opportunity been given the electric company to provide against it.

It may also be that the electric company wishes to coöperate with the telephone company in some change of route of one line or the other which can most effectively be carried out when a full knowledge is possessed of the plans of both.

Rules stand still but the art progresses. If you do not revise rules from time to time they impede development, maybe development of telephone business, maybe of electric business, possibly of railroads or of safety work. General Order 115 is not a repeal of General Order 30, but rather a supplement to it, on account of new needs. Summarizing then:

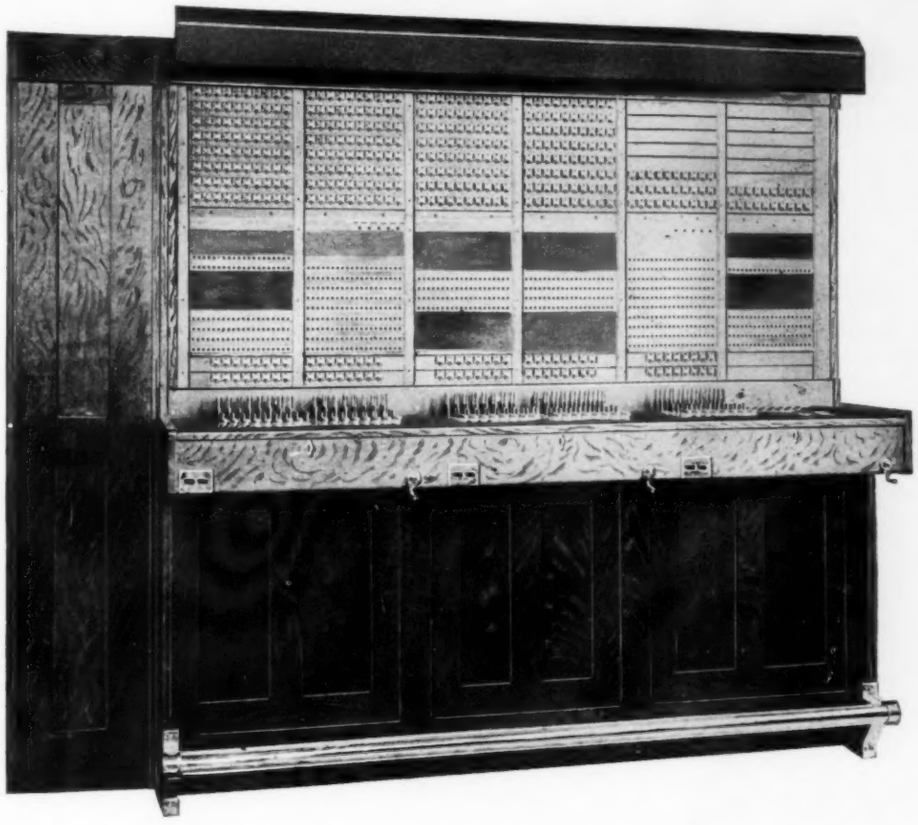
First, we need rules in the interest of safety and service. Although in the matter of safety, which is the principal object of the rules, let us remember that utilities can do much more than any set of rules by proper instructions to, and education of, employes in safety practices and procedure. No device, rule, set of rules, or instructions, can be as effective in the interest of safety as can a careful man.

Second, we need revisions of rules from time to time to meet developments in the industry.

Third, rules should be specific, comprehensive, yet easily understood; should promote safety, insure reliable service, improve coöperative relations, encourage uniformity and serve as a useful guide to practice.

Perhaps a note of warning should be sounded here. As previously stated, the rules will establish minimum, not average, values and it is to be expected that utilities will generally build better than the requirements demand.

Minimum strength requirements and minimum clearances should be exceeded where it is economical to do so. It takes practically the same amount of labor to set and frame a large pole as a small one and even where reliability of service does not require it, it is sometimes good economics to set a larger pole than strength requirements call for, because of a saving in replacement expense.



Greater Operating Speed For Magneto Exchanges

is made possible by use of the Leich Magneto Multiple Switchboard

Exchanges that formerly had great difficulty in giving service on plug restoring drop switchboards have been able to reduce their operating force and at the same time greatly improve the service to their subscribers.

Multiple answering jacks distribute the load among the several operators, who can answer and complete any call coming in on the switchboard without passing cords or trunking to an adjacent position.

Regardless of the type of manual equipment the human element enters into the service and for handling the traffic created in exchanges of 1000 lines or less, the Leich Magneto-Multiple Switchboard adequately meets the requirements.

More elaborate equipment will give no better results in the smaller exchanges yet the increased fixed charges on a complicated switchboard will bring the operating costs up to a figure that will make operation at a profit questionable.

There is never any doubt about Leich Magneto Multiple Switchboards proving profitable. The first cost is but slightly greater than a plug restoring drop switchboard and there is a decided economy in operation.

LEICH ELECTRIC CO.

Telephones, Switchboards, Accessories

GENOA, ILLINOIS

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ELECTRIC APPLIANCE COMPANY
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Kansas City, Mo.

LINE AND DESK

EFFECT OF CABLE CAPACITY

The perennial question as to methods of specifying capacity of lead-covered cable is brought up again by the following query which has come to this department: "We are in the market to purchase some cable and are confused as to the capacity. Will you please explain the difference between ground capacity and mutual capacity? Which gives the better transmission, .08 ground capacity cable or .08 mutual capacity cable?"

There are two methods of measuring the capacity of cable conductors. The result obtained by one method is called ground capacity, while that obtained by the other method is called mutual capacity. The methods of making the measurements are as follows:

Ground Capacity—

All of the conductors of the cable are bunched except a single conductor which is to be tested. The insulation is stripped from the bunched ends and the wires are tied together and connected to the sheath. A measurement is made of the capacity between the wire under test and all of the other wires and the sheath tied together.

Mutual Capacity—

In this test all of the wires are bunched and grounded on the sheath as before except one pair of wires which is to be measured. The measurement is made between the two wires of the pair and the result is called the mutual capacity.

Ordinarily the average ground capacity is a little more than one and one-half times the mutual capacity. Thus a cable having a mutual capacity of .070 mf. per mile has a ground capacity of .110 mf. per mile. Since the principal factor in causing transmission loss in cable is the capacity, it follows that the cable having the higher capacity has the greater transmission loss. On the other hand, low capacity cable costs more and there is a point below which it is not economical to go. In answer to the question as to which gives better transmission, .08 ground capacity or .08 mutual capacity cable, it must be said that the former would give the better transmission, but cables as low as .08 ground capacity are no longer made. Some of the old-time loose core cable had capacity as low as this, but modern cable seldom runs below .10 ground capacity.

One manufacturer of cable gives the following transmission equivalents for No. 22 B. & S. ga. cable of various capacities:

Mutual Capacity (mf. per mi.).	Ground Capacity (mf. per mi.).	Transmission Equivalent (miles of standard cable).
.070	.110	1.53
.080	.128	1.63
.090	.140	1.73
.100	.155	1.83

These figures indicate that the effect of increased capacity between the lowest and the highest value given is equivalent to increasing the length of the line about 20 per cent as far as transmission loss is concerned.—Staff Contribution.

HAZARDS OF THE SUBSTATION INSTALLER

We safety men are constantly shouting: Don't do this! Don't do that! Danger! Beware! Continually waving the red flag and crying Wolf! Wolf! Aren't we going too far in this direction? Personally, I believe we are. You know if you hammer and hammer on a subject in the same way, time and time again, eventually you lose the reaction and all is lost. Let's stop before we reach this point. Let's give the forces something cheerful to drive out some of this gloom. Something cheerful! That's new—can it be done? It can, and with proper study you will find it almost as easy to find cheerful points on accident prevention as you have in the past to find gloomy ones.

We've started cheerful accident prevention work in the Western division. As our initial effort in this line, our next accident prevention bulletin pictures five linemen, one from each of our five districts. These five linemen have never had a lost time accident and every man has a record of more than twenty years' service. Totaling well over one hundred years of safety! That is cheerful news and I feel sure will bring the desired reaction. There are a lot more that can easily be featured.

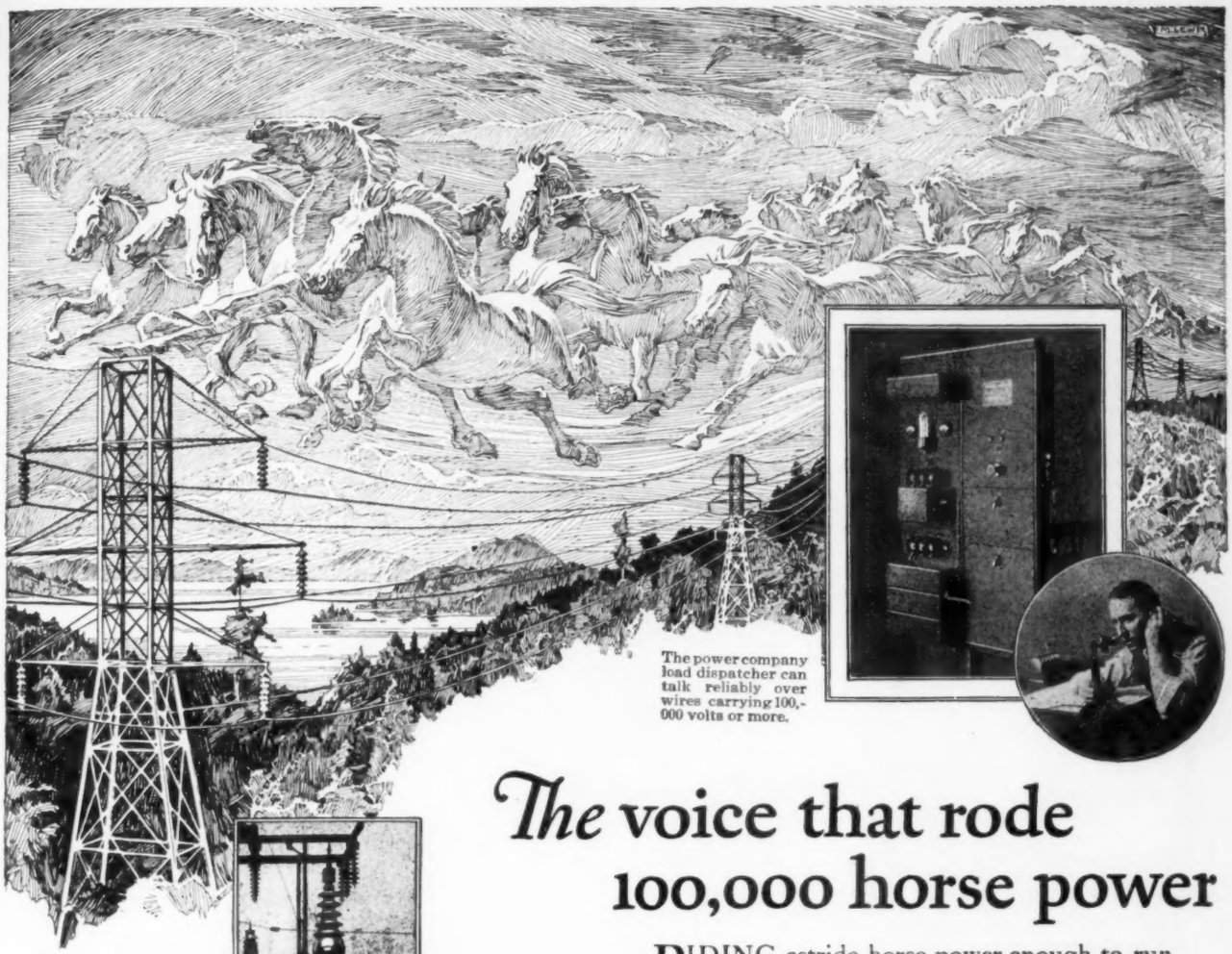
My subject being "Hazards of the Substation Installers," let me say, I'm strong for the installers. They're a mighty fine bunch of safety workers. We have approximately 100 of these men in the Western division and when I tell you these 100 men have worked every day for the first nine months of this year without a lost time accident, do you wonder I'm strong for the substation installers? Out of a total of 44 lost time accidents this year the installers have not contributed one accident. That's cheerful news and worth spreading.

But what's the idea? Don't these installers have hazards? They certainly do! They encounter the traffic hazard in going from job to job. They have the weather hazards which, especially in winter, are severe. In the houses they encounter cellar stairs in all sorts of conditions. In the cellars where the majority of their work is done they find barrels, boxes, boards with nails, beams, pipes, engine pits and even water wells to ensnare and entrap them. They work alone; there is no foreman to watch and correct faulty methods of doing work, there is no fellow employe there to warn them of dangers, they are their own boss of the job and every man is on his own initiative. This department carried another hazard and an important one; the hazard of the new man. A large proportion of the new men hired to go with the installation work, and with every new man we have the two hazards—youth and unskilled labor. Everyone knows the importance of these two hazards. Effective means must be devised to combat this hazard.

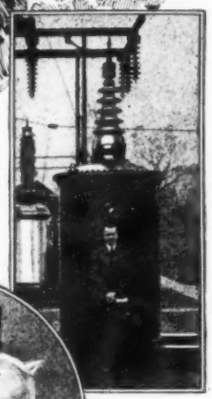
With the scheduled large increase in forces for the next few years, the hazard of the new man looms large and of vital imporfance. But this hazard can be successfully combated.

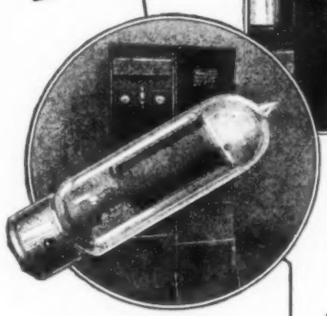
The first step is the careful selection of new men. Our apprentice situation is enviable when compared to the other trades. When other trades are experiencing an alarming shortage of apprentices, we are overwhelmed with applicants for positions. We are in a position to pick and pick with the greatest of care.

To my mind, this should be accomplished by the establishment of a division employment bureau with a firm policy and with one interpretation of that policy. Education, physical characteristics, temperament, adaptability to our work, etc., are of vital importance in selecting new men.



The power company load dispatcher can talk reliably over wires carrying 100,000 volts or more.





Amplifying vacuum tube. This is one of a number of vacuum tubes used in the transmitter circuits.

Not a giant chessman. This coupling condenser gives the voice currents safe conduct from telephone instruments to power line.

On a cross country power line any station can talk with any other — with Western Electric equipment.

The voice that rode 100,000 horse power

RIDING astride horse power enough to run an industrial city, came the voice over the wire, "Bad storm put Mill City line out of commission, tie in Springvale circuit."

Now electric light and power company operators can telephone over their own power transmission lines carrying thousands of horse power. Yet they talk and signal with ease with a few thousandths of a horse-power by the use of the Western Electric Power Line Carrier Telephone Equipment.

It is the most satisfactory means yet devised for communicating between the stations of companies which cover a wide area and where commercial telephone facilities are not available. It is an important aid in emergency and it helps maintain service twenty-four hours a day.

Here is a worthy newcomer to the long list of products manufactured by the world's largest maker of telephones.

Western Electric

SINCE 1869 MAKERS OF ELECTRICAL EQUIPMENT

The next step with the new man is to properly train him before he goes into the field. This should be accomplished by the means of a division school where he will be taught Organization and Policies of the Company, Safety Program and First Aid and practical experience in the actual handling of our tools.

Too much stress cannot be laid on the attitude of the new man when he goes into the field, and if he does not have the right attitude, we are to blame. The responsibility is ours and we cannot afford to neglect it.

First impressions are vital. Give the new man the right impression at the start and the battle is half won.

In conclusion let me leave with you three outstanding points:

First—Cheerfulness. Inject all you can in your safety program. It will put the work on a better plan.

Second—There is a pressing need of an established system of awards for meritorious safety work.

Third—Careful selection and thorough training of all new employes.

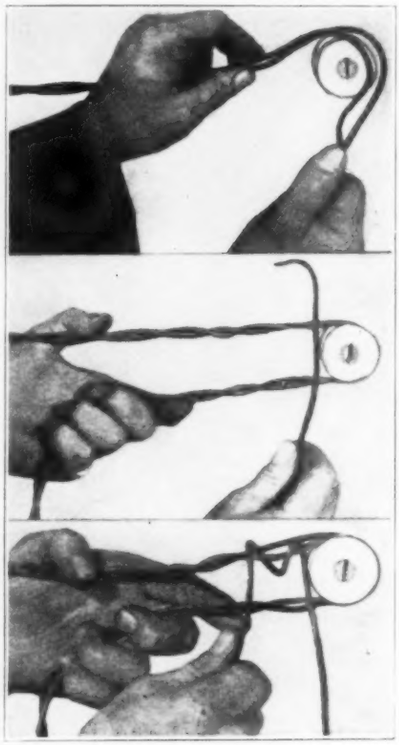
The adoption of these three points will, I am sure, materially assist us in the successful carrying on of our safety campaign.—W. F. Gowdy, in *Telephone Topics*.

BUGS WE HAVE SHOT

Every repairman can tell of peculiar cases of trouble which cause failure of bells to ring properly, but a New York repairman found a unique case, which is described in "Telephone Topics." When he opened the bell box out rolled a lot of pennies. The subscriber proudly explained that it was his savings bank.

A MAN-POWER POLE DERRICK

Before the days of the motor truck and the power derrick for raising poles the writer was compelled to devise a hand power derrick which he used for several years on small poles. He was running a small exchange as a one-man job, and, most of the time, money for a helper was not to be had. The derrick was made of a piece of spruce about 14 feet long with a single sheave mortised into the upper end. The lower end was fastened to a cross piece and the vertical piece was braced to the cross piece. A wooden drum with an iron handle was used to take up the rope which passed over the sheave. Another single sheave block with a hook completed the derrick. After the hole was dug, the pole was placed with the butt over the hole and a sling of rope was fastened to the pole. The derrick was set up and the rope wound on the drum to raise the pole. Light, 20-foot and 25-foot poles could be set easily with the derrick, which was light enough that it could be carried on a man's shoulder.



Motion Study Method Making Dead End Tie.

Courtesy of "Bell Telephone News."

Probably the best job ever done with it was the setting down of a mile of badly rotted poles during a sleet storm. The derrick was set up alongside the pole and the rope was tightened so that the derrick took the strain. The pole was then cut off, a new hole dug and the pole set down and tamped. This work was done while the ice was still on the wires, and probably prevented the entire line from coming down.—Contributed by T. E. Conrad.

NO LATE SLEEP FOR THE TOLL PLANT MAN

Late morning hours are not for combination men, non-functional managers, toll repairmen and others connected with the toll lines. Despite tracing of the location of trouble by means of "bridge testing" by the instruments in the toll wire tester's office, there is always a certain amount of toll line patrolling to be done, to find the place, examine the nature of the trouble and make repairs.

Along highways, the morning task is comparatively easy, but there are times when roads are impassable and

(Concluded on page 37.)

"Red Devil"
Linemen's Tool Belts

Linemen themselves have made this tool belt popular. The standard of the Pennsylvania Railroad.

Details of Construction: Made of fine oak tanned, heavy hide. This belt is double thickness across the back. D's are let in between two layers, worked down flat and firmly secured by three rows of linen stitching and copper rivets. The buckle is sewed in with three rows of linen stitching and copper rivets. Five loops; one 2-inch, one 2½-inch, two 3-inch and one 4-inch. Loops have round edges and are scored. Has keeper for plier. Sizes 36 to 44 inches. No. 158, width, 2¼ in. Average weight, 2 lbs. each.

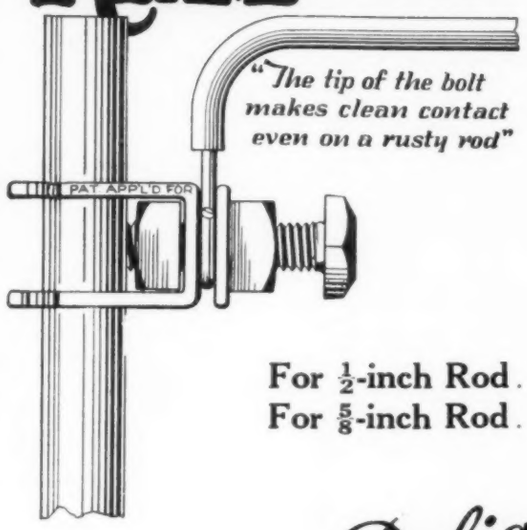
All dealers sell "Red Devil" Tools—if not in stock send dealer's name, and we will see you are supplied.

Send for the electrical tool booklet—free.

SMITH & HEMENWAY CO., Inc.
Mfrs. of "Red Devil" Electricians' Tools
Dept. T. E., 261 Broadway, New York, N. Y.

TRADE MARK Red Devil Tools — "Red Devil" THE WORLD'S STANDARD — Better Made

KLING KLAMP FOR GROUND RODS



WHY *MONKEY* WITH SOLDERED RODS?

For ½-inch Rod . . . . . 15c each
For ⅝-inch Rod . . . . . 18c each

Quantity Discounts
100 lots—10%
1000 lots—20%

Reliable Electric Company
3145 Carroll Avenue, CHICAGO, U. S. A.

(Continued from page 28.)

B. J. Mullaney's absence made it necessary for his talk on the work of the Illinois Committee on Public Utility Information to find a very interesting substitute in the remarks of J. G. Mitchell, Ralph Dexter, E. D. Glandon and George X. Cannon on the subject which had been allotted to Mr. Mullaney.

In the concluding feature of the convention, an open forum, there were discussions which brought out the legal right of telephone companies to forbid the use of attachments on their telephones, and on the borrowing of telephone service, particularly by magazine subscription solicitors, an evil which has been discussed by other state conventions. In one case at least an Illinois telephone company had filed with the commission a schedule of rates for this service.

Traffic Conference Packed.

Registration for the traffic conference reached 176, and the lively, practical program attracted, in addition to the operators, many of the executives who were interested in a close-up of the spirited sessions conducted by Miss Marguerite Norris of La Porte, Ind.

The program of the traffic conference presented:

Ways of Coöperating with the Traveling Chief Operator of Your Association, Miss Anne Barnes, Des Moines, Iowa.

Ways and Means of Completing Long Distance Business, Miss Ruth Haemptfling, Monmouth, Ill.

Price of an Unfriendly Feeling, Mrs. Loretta Cusick, Springfield, Ill.

Public Relations from the Operator's Standpoint, Mrs. Jesse Hill, Streator, Ill.

Common Questions and the Question Box, Mrs. Van Arsdale, Rockford, Ill.

The Recording Operator as a Saleslady, Miss Lillian Davis, Murphysboro, Ill.

Benefits Derived from an Operators' Conference, Miss Ruby Green, Clinton, Ill.

Our Work, Miss Martha S. Hudson, Springfield, Ill.

The Value of System in the Traffic Department, Miss Catherine Sullivan, Peoria, Ill.

The Goal of the Traveling Chief Operator, Miss Esther Sorenson, Springfield, Ill.

The Voice from the Switchboard, Miss Gladys Hamilton, Jacksonville, Ill.

The Place of the Traffic Department in the Organization, Mr. E. L. Gaines, Fort Wayne, Ind.

(Continued from page 36.)

there are toll lines along railroads or through private rights of way. That means using horses or walking, generally walking. Over stretches of sparsely settled country in western Nebraska and the Dakotas, up and down mountains in the Black Hills section, through the deep forests of northern Minnesota, every foot of wire is watched.

The clear voice proving the perfection of transmission may find its path barred by storms. Then the problem is to restore transmission at the earliest possible moment. Report of the damage must get to headquarters by all means. If all wires are down, then by auto, by train, by foot or by boat. "Get that report in" is the slogan of the plant men, and hundreds have braved floods, storms and fire in doing so. With the report in, steps can be taken to meet the emergency and restore transmission.—Cyrus P. Finley, in "The Northwestern Bell."

Golloday Buys Control of Johnson County (Mo.)

Holden, Mo.—M. L. Golloday, general manager of the Holden Home Telo. Co., has bought controlling interest in the Johnson County Home Telephone Co., and will assume active management of this company. Mr. Golloday will retain his controlling interest and management of the Holden company.

Strowger Director System

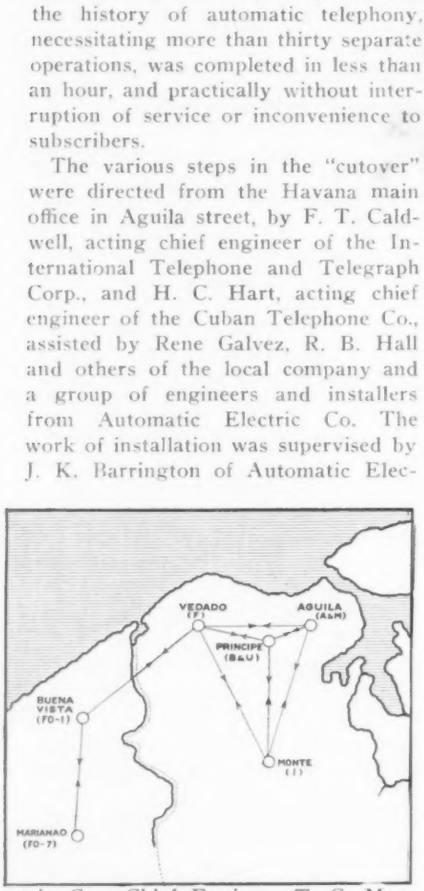
Director Trunking in Havana Network Meets With Gratifying Success — In Spite of Unusually Heavy Load, New Equipment Upholds Strowger Automatic Reputation for Accuracy of Performance

The first Strowger Automatic "directors" in a public exchange now are clicking busily and buzzing calls through to completion for the telephone users of Havana. Thus the Cuban Telephone Co., already noted for operating the busiest telephone exchange in the world, now has the added distinction of being the pioneer user of a device proclaimed as one of the foremost developments of the century in telephone switching.

The Cuban director installation was successfully completed and cut into service Saturday midnight, November 15th, coincident with the establishment of two new automatic central offices in Havana.

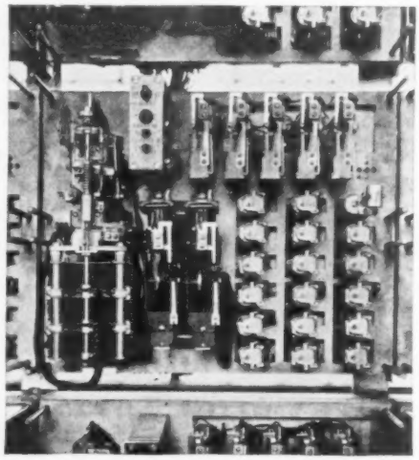
The actual work of inaugurating the new arrangement, while one of the most difficult and involved projects in the history of automatic telephony, necessitating more than thirty separate operations, was completed in less than an hour, and practically without interruption of service or inconvenience to subscribers.

The various steps in the "cutover" were directed from the Havana main office in Aguila street, by F. T. Caldwell, acting chief engineer of the International Telephone and Telegraph Corp., and H. C. Hart, acting chief engineer of the Cuban Telephone Co., assisted by Rene Galvez, R. B. Hall and others of the local company and a group of engineers and installers from Automatic Electric Co. The work of installation was supervised by J. K. Barrington of Automatic Electric Co. Chief Engineer T. G. Martin and Superintendent of Installation and Operation H. P. Mahoney, both of Automatic Electric Co., were present at the cutover and for a few days afterwards to study the operation of the directors under actual service conditions.



What is a director? How does it work?

By reference to a specific installation, such as that in Havana, we can tell something of what the director accomplishes, and how it simplifies the trunking plan of a large city network.



Close-up of Director.

Stripped of all miscellaneous features, the present Havana automatic system consists of the simple network shown in the accompanying map. Each of the four exchanges in what may be called "old Havana" has an ultimate capacity of one or two 10,000 line units. There are direct trunks between all offices and each telephone number consists of an office prefix and four figures. Principe is one of the two newly established offices mentioned in the opening paragraph.

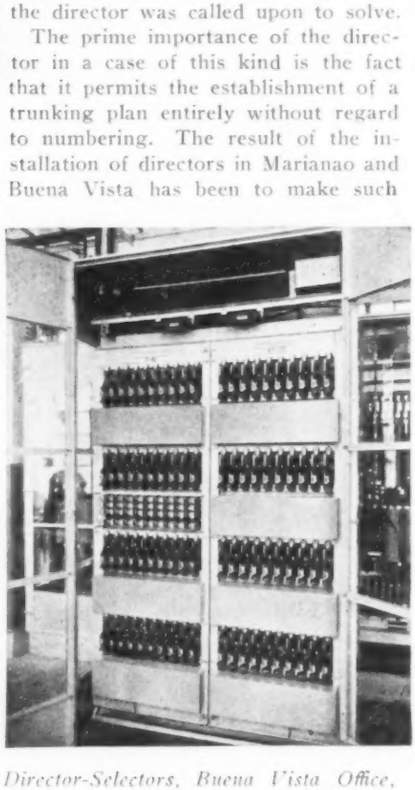
Some years ago, an automatic sub-office was opened at Marianao, a more or less isolated municipality to the southwest of Havana proper. The traffic here was largely local, and the exchange was, until the recent cutover, treated as a local affair with free automatic trunking to Havana via Monte office.

The development in the section north of this office in the past few years became so pronounced that it was decided to install another sub-office (Buena Vista) to relieve the Marianao office. Meantime, the traffic between these districts and Havana had grown to such proportions that service and other considerations demanded that the new district be included within the Havana area, and the whole network covered by a comprehensive numbering plan with whatever changes were necessary to make ample provision for future developments.

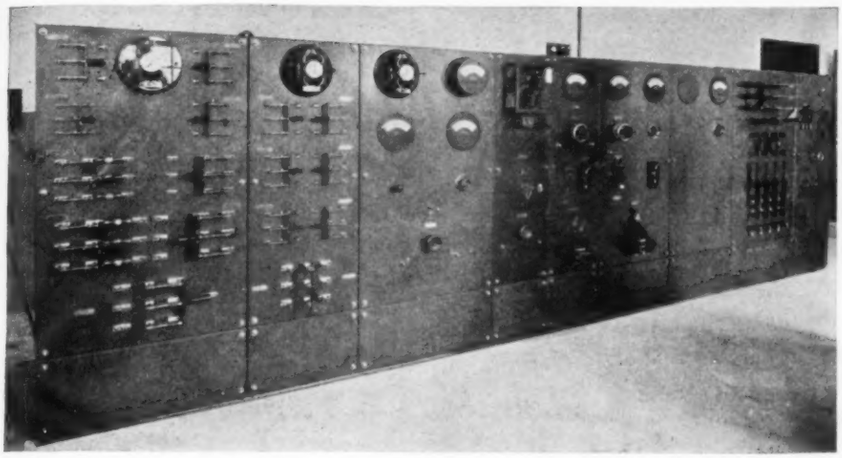
Disregarding the director for the present, the trunk connections to the Havana offices could have been handled in a number of different ways, but even the most efficient of them would have necessitated direct trunks from each of the two sub-offices to every other office in the network—a very uneconomical arrangement under these particular circumstances.

An ideal method would be to route all of this traffic over one group of trunks from Buena Vista to Vedado, but how to do this and still maintain universal numbering was the problem the director was called upon to solve.

The prime importance of the director in a case of this kind is the fact that it permits the establishment of a trunking plan entirely without regard to numbering. The result of the installation of directors in Marianao and Buena Vista has been to make such changes in the number and combination of the impulses generated by the dials of subscribers in these districts that calls to Havana will be directed



Director-Selectors, Buena Vista Office, Havana.



Power Switchboard, Principe Office, Havana.

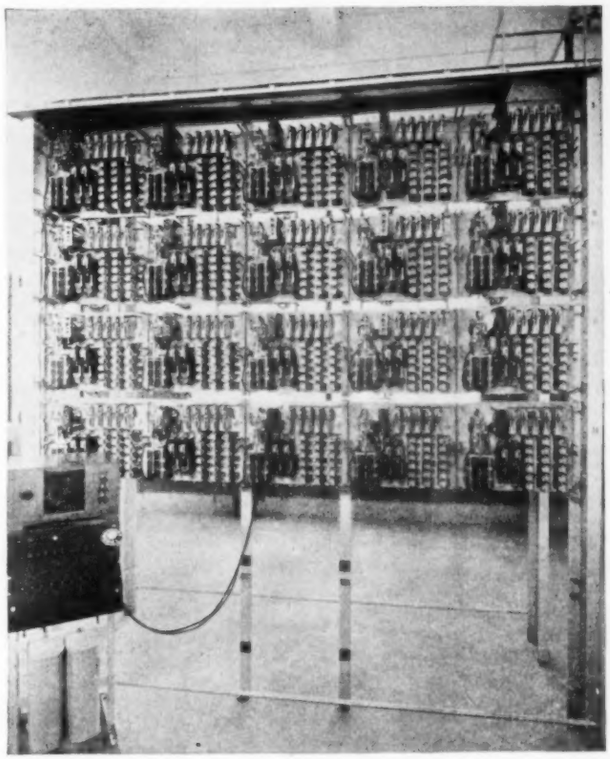
over the simple tandem trunk route indicated in the map.

To illustrate: Suppose a Marianao subscriber dials the number of an Aguila subscriber, say A2345. Without the use of directors, dialing the first digit "A" would necessitate routing the call over one of a direct group of trunks to Aguila office. The director, however, on receiving and registering the five series of impulses, first sends out two series of impulses corresponding to 3-0," which extends the connection through Buena Vista to Vedado. The director then sends out the five digits exactly as received over this trunk route and the rest of the connection is taken care of just as if the number had been dialed by a Vedado subscriber.

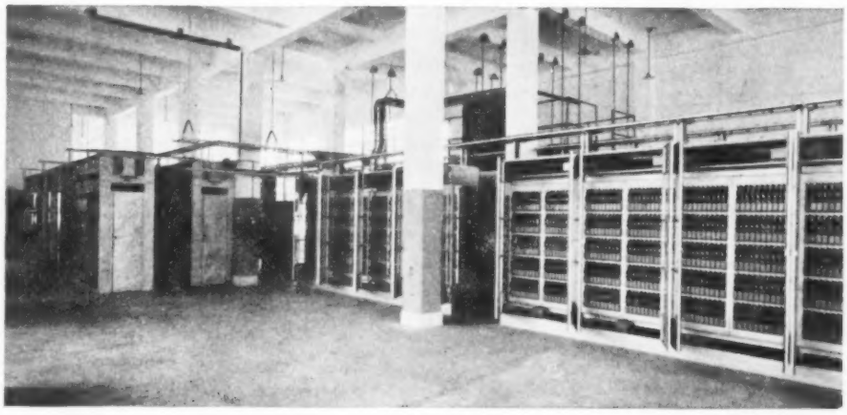
Another example of the director's usefulness is found in the case of a local call, say, from a Buena Vista subscriber to another in the same office, say, FO2354. Under the old plan, such a call might be routed through first, second, third and fourth selectors and a connector in the local office, or might even be routed to Vedado and back again, depending on the plan in operation.

The director, however, handles this call by receiving and registering the six sets of impulses, dropping the first two digits entirely and sending out the last four, the call being completed via a local thousands selector, hundreds selector and connector. The call is thus completed wholly within the office and office selectors are dispensed with entirely, both of which features form an important item of economy in a situation such as this one.

Since the directors are in use only during the time a connection is being established, the number of directors needed is relatively small. Twenty directors have been installed in each of the Buena Vista and Marianao offices, and service observations made since they were cut in service have shown



Twenty Directors Installed and Covers Removed.



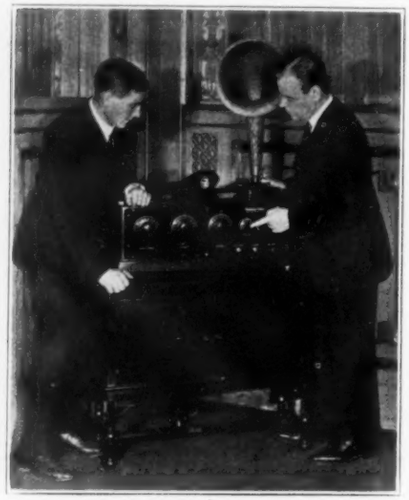
New Principe Office, Havana, Cuba.

that, while during the busy period the directors are in use practically all of the time, no calls were being lost because of lack of facilities. A director is reached through a director selector (a non-digit type, having a rotary mechanism only) connected to the primary line switch trunk.

The progress of the director installation in Havana has been watched with intense interest by operating engineers and executives all over the world, and its smooth and accurate operation since the cutover has been a source of great gratification, which, undoubtedly, will have its effect on the development plans for other cities where similar conditions prevail.

Zep's Radio Expert Takes Stromberg-Carlson Set Home

New York, N. Y.—Hans Ladwig, one of the leading German radio operators, who was assigned to the ZR-3 for its famous trans-Atlantic trip, has



Jack Binns and Hans Ladwig.

taken a Stromberg-Carlson Neutrodyne receiver and loud speaker back to Germany with him. Ladwig and Jack Binns, the well-known radio expert who first figured in print as hero of the Republic sinking, were photographed together in New York during an examination of the S-C outfit.

Ladwig thought so well of the Rochester product that he wrote the dealers from whom he made his purchase as follows:

"John Wanamaker,
"Astor Place,
"New York City.
"Gentlemen:

"Since my arrival from Germany on the airship ZR-3, I have spent much time studying the progress of radio in the United States. I have been greatly impressed with American-made receiving sets and especially with their advancement in the last few years.

"The chief purpose of this letter is to tell you that after careful study of the market, I have bought from your radio department, a Stromberg-Carlson Neutrodyne Receiver and loud speaker to take back to Germany with me. It is the finest equipment that I have ever seen."

PRIVATE OWNERSHIP IN EUROPE.

Advocates of government ownership of telephone systems will find small comfort in the recent announcements that the underdeveloped and dilapidated systems of Spain and Greece are to be taken over and rehabilitated by private companies. Southern Europe has been very backward in telephone development, but with Spain and Greece following the lead of Italy and with the possibility that France also will fall into line in placing private enterprise in control, it is not beyond reason to expect these southern nations to outstrip their northern neighbors who still cling to the fetish of government ownership.

Odell Heads Advances in W. E. Lineup

New York, N. Y.—J. B. Odell, manager of the New York Telephone Distributing House of the Western Electric Co., has been appointed assistant to the president of the company. Mr. Odell's place will be filled by R. B. Gordon who has been stores manager. O. Whitmire, stores manager at Boston, will come to New York to take this position. Mr. Odell has been in the service of the Western Electric Co. since 1904 when he joined the company in New York.

Mr. Gordon, who succeeds him, has been with the Western Electric Co. since 1894 and held the post of stores manager in New York. Mr. Whitmire, succeeding Mr. Gordon, joined the company in Chicago in 1910 and became stores manager in Boston a year ago. In this capacity he is succeeded at Boston by R. J. McBride who has been acting as distribution specialist in the Telephone Department at New York.

Philadelphia, Pa.—Thomas E. Cornish, an organizer and director of the Bell of Pennsylvania, and the first man to string telephone wires in the state, died here Nov. 1 at the age of 86.

Kerrville, Tex.—Approximately $50,000 is to be spent in improving the local telephone property.

WANTED — Copy of TELEPHONE ENGINEER for March, 1924. Will extend subscription three months for same. Address TELEPHONE ENGINEER, 28 E. Jackson Blvd., Chicago.

Save 75% on Blue Prints-

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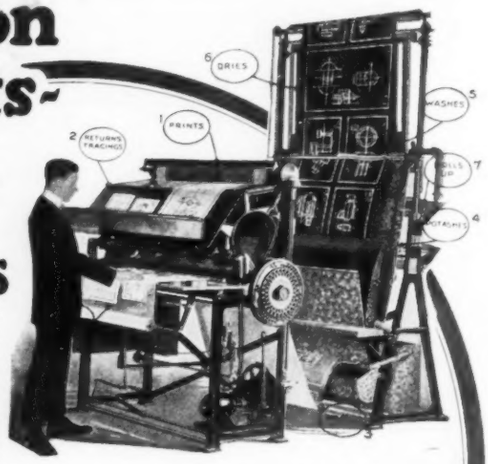
Why pay the cost of printing blue prints by the old "3 process" method —changing them from one machine to another, when you can do the complete job perfectly on ONE machine—in a fourth of the time—at a 75% saving of costs?



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Pacific Tel. & Tel. Co., San Francisco, Cal. New York Telephone Co., New York City, N. Y. Bell Telephone Co., Philadelphia, Pa. Southern Bell Tel. & Tel. Co., Richmond, Va., and Atlanta, Ga. Michigan State Telephone Co., Detroit, Mich.

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Send coupon for booklet. It gives detailed facts on savings.

Blue Printing Machinery Blue Printing Accessories

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6" 4-way	6,000 lbs.
8" 2-way	6,000 lbs.
8" 4-way	10,000 lbs.
10" 4-way	16,000 lbs.

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Send for free sample and prices on
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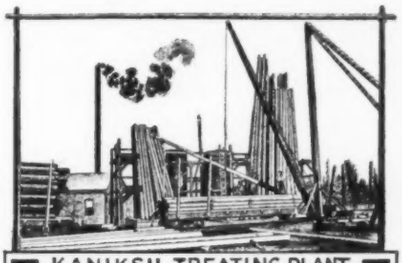
Universal Specialty Company
120-A, S. 7th St., Terre Haute, Ind.



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COMING CONVENTIONS.

South Dakota, Aberdeen, Jan. 14-16.

Minnesota, St. Paul, St. Francis Hotel, Jan. 20-22.

Wisconsin, February 10-12.

Nebraska, Lincoln Hotel, Lincoln, February 17-19.

North Dakota, March 10-12.

Ohio, Columbus, New Southern Hotel, March 24-26.

Kansas, Topeka, Hotel Kansan, April 7-9.

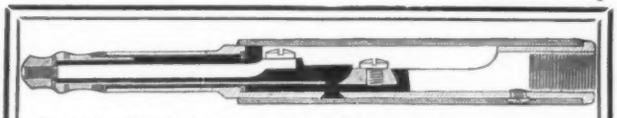
Pennsylvania, Harrisburg, Penn-Harris Hotel, May 5-7.

New York, Rochester, Powers Hotel, May 13-15.

TO MAKE ASSOCIATION MORE HELPFUL.

The United States Independent Telephone Association is framing plans to make its membership available for every Independent telephone company in the country, large or small. When the plans are announced, every member of the association should become a salesman of memberships to non-members in its vicinity, so that the association may be truly representative of the entire Independent group in all matters of national importance.

WANTED: Chief Telephone Engineer well up in British P. O. circuits, manual boards and instruments by large firm of telephone manufacturers in England who are developing this side of their business. State age, salary required and when free. Strict confidence will be observed. Box No. 1202, Dorland Agency Ltd., 14 Regent St., London, England.



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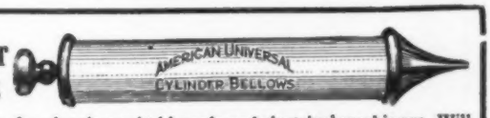

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579 St. John Street Quebec, P. Q., Canada

(Continued from page 21.)

be considered a substitute for the longer and better open tank treatment, but it will unquestionably be effective and will prolong the life of the poles for several years at least.

(Continued from page 23.)

mands of the public. Then calculate your costs, explain your situation by real and effective publicity, and demand fair pay for the goods you deliver—just as every other efficient and able merchant does if he continues in business and keeps pace with the town in which he operates.

With a million and a half subscribers in the state already and hundreds of thousands more who will require service within the near future, this is a difficult thing to do. But we'll have to do it. Through Chambers of Commerce, Rotary, Kiwanis and Lions clubs, women's clubs and other civic organizations, through Merchants' associations, church organizations and employe group meetings we can get our message over if we have all of our own people—not only our presidents and general managers and commercial representatives, but all the clerks and operators and repairmen, installers, linemen and all others—posted and interested and intelligently informed.

Then we can prove our case to all of our customers if we use the right kind of simple statements of the truth of the situation confronting us.

Minnesota Convention, Jan. 20-22, St. Francis Hotel, St. Paul

St. Paul, Minn.—J. C. Crowley, secy. of the Minnesota Telephone Assn. announces that the next annual convention of that organization will be held at the St. Francis Hotel, St. Paul, January 20, 21 and 22.

Kent, O.—Extension and improvement of the Ohio Bell facilities here are costing $75,000.

Of the 84,000 telephone subscribers in Tokio, Japan, 28,000 now are getting service. In Yokohama there were 10,000 telephones before the earthquake. 2,500 are operating now.

Negotiations are in progress for the establishment of telephone service between England and Denmark.

Jasper, Ind.—The Dubois County Telephone Co. has let a contract for a brick general office. Cost will be approximately $25,000.

Bunceton, Mo.—Work is nearing completion on the new building of the Bunceton Telephone exchange.

Statistics Show Large Increase in Timber Preservation

In a recent publication of the Forest Service, U. S. Department of Agriculture, "Quantity of Wood Treated and Preservatives Used in the United States in 1923," R. K. Helphenstine, Jr., gives some interesting statistics showing the increase in use of preservative treatment of wood. Creosote is the principal preservative used and in 1923 the amount used was 127,417,305 gal., an increase of 42 per cent over 1922. At the close of 1923 there were 147 treating plants in the United States of which 135 were active and 12 were idle. Treated timber was divided into seven classes and each class showed an increase over 1922. The number of poles treated in 1923 was 1,527,665, an increase of over 50 per cent over 1922. Of the poles treated 979,368 were cedar, 88,773 were chestnut and 451,852 were southern pine. The remainder were other woods. The cedar and chestnut poles were practically all butt-treated while the southern pine were all given a full pressure treatment.

Norwalk, O.—Local Telephone Co. has purchased a two-story brick and concrete building which is being remodeled for use as the company's headquarters.

Valuations Rate Cases — Financial Reports Plant Studies
Charles W. McKay
Telephone Engineer
440 WRIGLEY BLDG., CHICAGO

W. H. CRUMB
Telephone Engineer
9 South Clinton St. Chicago

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Dowel Pins
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(Tel. Haymarket 9189)

J. K. JOHNSTON
Telephone Engineer
903-4 Lemcke Bldg. Indianapolis, Ind.
Has appraised exchanges as follow: Arkansas, 2; Florida, 2; Illinois, 8; Indiana, 219; Iowa, 5; Kentucky, 21; Michigan, 20; Missouri, 2; New Jersey, 2; New York, 2; North Carolina, 6; Ohio, 71; Pennsylvania, 23; South Carolina, 4; Tennessee, 12; Virginia 11; Total, 410.

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Keeps the records and makes up all reports for companies (large and small) in 17 states. The cost is about half the salary of a bookkeeper. It will not cost you anything to inquire as to our plan, charges, etc. Write today.
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Southern Yellow Pine—Straight, Full-Bodied—Pressure Treated Full Length—Safe Against Grass Fires—Decay Defying
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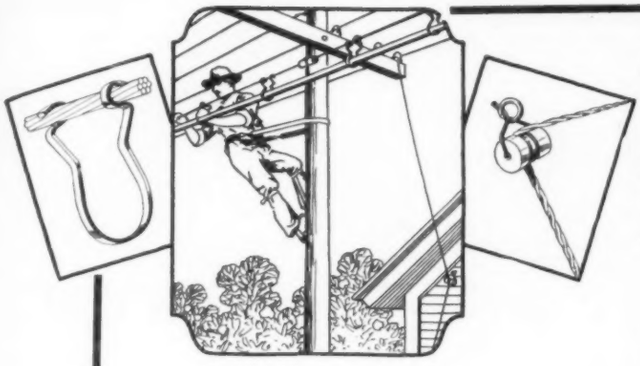
CEDAR POLES
NORTHERN ✣ WESTERN
BUTT-TREATING - GUARANTEED GRADES
ANY SPECIFICATIONS REQUIRED
BELL LUMBER CO., Minneapolis, Minn.



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have a flexibility that enables you to tie drop-wires with utmost ease, speed and economy. When occasion demands the C-B porcelain knobs can be readily removed from the bridle rings. For a neat job and low cost, use National C-B knobs.

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When the best protection costs no more, why not have it? BRACH arresters insure; non-grounding of lines, cables, clear transmission, balance of potential between pairs, and full protection against power crosses or lightning. There are no carbons to clean and no maintenance bills.

You can readily afford BRACH Vacuum Arresters at our present low prices. Type 440, shown above, is furnished with porcelain base, fuses and mountings.

L. S. BRACH MFG. CO.
NEWARK, N. J.

Suttle in New Plant

Telephone Equipment Company Moves to Own Building at Lawrenceville, Ill.

Lawrenceville, Ill.—Suttle Equipment Co., one of the foremost rebuilders of telephone and electrical equipment, and also printers of standardized forms for telephone company use, has moved from Olney, Ill., to its big new plant at 401, 403, 405 North Fifteenth street, Lawrenceville.

More than ten carloads of material were involved in the move. With the new home laid out especially for handling the rebuilding and printing work, and for stocking a large amount of telephone and electrical supplies many of the Suttle company's problems concerned with the rapid growth of the business will be solved.

Among the features of the new plant is a layout of printing equipment particularly fitted for the telephone form business.

A few weeks more and the Suttle company will be all squared away in the new plant, and the office force acclimated to Lawrenceville.

Often the Suttle company purchased the entire equipment of a plant that figured in a consolidation, and the rush of material that came in these deals made it urgent that the move to larger quarters be quickly consummated.

WANTED—Experienced man of ability to fill position of combination Wire Chief and Local Manager at an exchange of about 1800 stations. Equipment: old-type Stromberg-Carlson Common Battery; no competition. Man must have good recommendations as to ability and character. Salary, $175 per month with chance for advancement when merited. Address Manager, care TELEPHONE ENGINEER, 23 E. Jackson Blvd., Chicago.

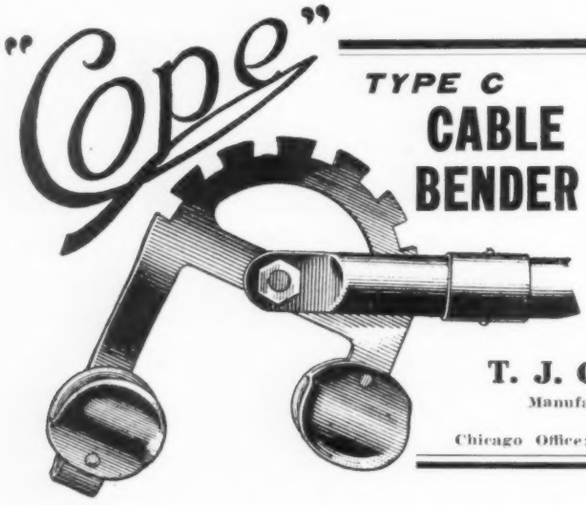
Stromberg's Peoria Exhibit Has Garden Setting

Peoria, Ill.—The Illinois convention got the close-up of one of the many activities of the president of the association, Dr. Gordon, when it flocked into the Stromberg-Carlson exhibit rooms. A number of prize flowers from one of Dr. Gordon's enterprises, a greenhouse, were on display.

"The pick of Stromberg-Carlson's garden," according to Paul D. Meyers, the company's Illinois representative, naturally was in the spotlight. The Stromberg-Carlson equipment shown at Peoria was as follows:

A Stromberg-Carlson No. 101 P.B.X. Switchboard, which is equipped with directory cards, removable trunk circuit plate and universal trunk circuit wiring; the No. 105 Magneto Switchboard, always interesting to convention visitors, on account of its keyboard supervision and automatically restored supervision; the No. 1155 Metal Wall Telephone with concealed gongs; the No. 986 Desk Stand; the No. 896 Wall Telephone; the No. 2-A Radio Receiver in a console cabinet with built-in loud speaker and space for "B" batteries, "A" battery and battery charger; the No. 1-A Loud Speaker and the No. 1-A Neutrodyne Receiver.

New Home of Suttle Equipment Co., Lawrenceville, Ill.



TYPE C
CABLE
BENDER

The increasing demands for larger sized cables in underground electrical transmission has created a demand for a cable bending tool so constructed that it could be adjusted to meet every condition or requirement that might arise in the placing of cables in manholes or vaults without disturbing other cables.

The Cope Type "C" Bender will meet these requirements.

The Cope Type "C" Bender is designed especially for bending soft core cables without injuring the lead, and to eliminate the necessity of redressing after bending.

The Cope Type "C" Bender is made of steel throughout, tested to withstand any reasonable strain that it would be subjected to. Its adjustments will permit the handle to be placed in seven (7) different positions.

No tool cart is fully equipped without one of these Benders.

T. J. COPE, 2112-2114 Samson St., Philadelphia, Pa.

Manufacturer of Tools and Supplies for Underground and Overhead ELECTRICAL EQUIPMENT

Chicago Office: No. 19 So. La Salle St. Western Electric Company, Distributors

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We carry large stocks of round singles, square single, two, three, four, six and nine duct, in standard and short lengths, splits, mitres and bends.

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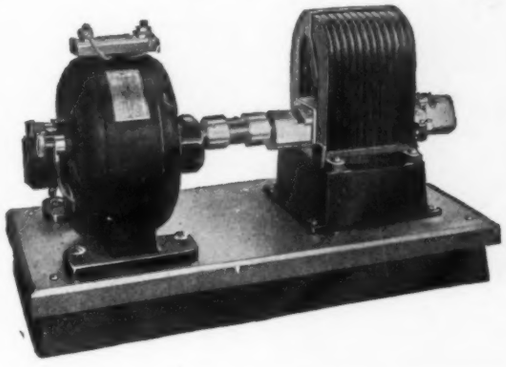
Generators vs. Batteries

Is your ringing service dependable and constant?



The Holtzer-Cabot Electric Company's Magneto-Ringing Motor-Generator does its work under any and all conditions, without variation. It **never fails.** No battery exhaustion; no renewals; no contact adjustments—**but constant service.**

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TELEPHONE AND TELEGRAPH WIRE

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Time and the aid of America's foremost engineers, have enabled us to develop and manufacture the highest grade wire known to the trade. It is greatest in conductivity and lasting qualities, due to the superior quality of material from which it is made, as well as its *Extra Double Galvanizing,* which insures longest life.

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Single and Double Galvanized, Standard, Siemens-Martin, High Strength and Extra High Strength Grades.

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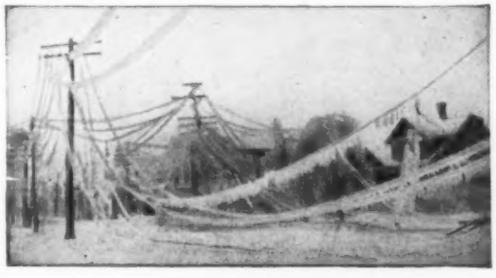

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TELEPHONE WIRE
DOES NOT FAIL

Copperweld is 50% stronger than the same diameter hard-drawn copper or BB Galvanized wire and much safer.

Even a two size smaller Copperweld wire is 20% safer.

Copperweld stays up under sleet and wind where other wires would be wrecked.

For reliability, strength, light weight, low resistance and non-rusting qualities specify—"Copperweld."

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COPPERWELD WIRE IS MADE BY THE MOLTEN WELDING PROCESS

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Telephone Wire and Cables

Bare Copper Wire
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Write our nearest office for complete information.

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Money saved is money earned

WINTER TROUBLE

The "STEWART" Test Set saves miles of travel. Every mile travelled costs money and "winter" miles cost more than "summer" miles.

By telling which way and how far trouble is from the tester without opening the lines, the "STEWART" Test Set will save these costly miles as well as time and material.

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STEWART BROTHERS, Ottawa, Ill.

YAGER'S
Soldering Salts

Old, tried, safe, quick Economical.

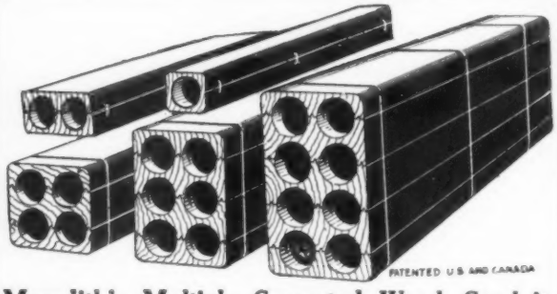
Used wherever soldering is done.

Packed in ½ lb., 1 lb. and 5 lb. enameled cans.

Sample on request.

Alex. R. Benson Co., Inc., Hudson, N.Y.

For list of distributors, see McRae's 1924 Blue Book



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3-inch bore, 2 to 12 duct
Single conduit 2, 2½ and 3-inch bore

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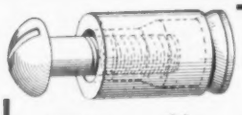

The "hump" holds in the hole

Greater expansion, with a given amount of lead, lends maximum holding power to the Chicago Expansion Nut. Pressure is distributed evenly in all directions; there can be no cracking or splitting of material.

Because of its strength, simplicity and economy, the Chicago Expansion Nut is standardized by leading telephone companies.

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CHICAGO EXPANSION BOLT CO.

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Also manufacturers of Bridle Rings, Toggle Bolts, Expansion Bolts and Expansion Pipe Hooks.

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Unequalled for telephone and bell wiring. The fiber insulation prevents troublesome short circuits and grounds. 4 sizes. Pat. Nov., 1900. Write for samples.

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They are available in all of the four styles shown on this page, in both wall and desk types, for manual or automatic service; or equipped with either dial blanks or writing pads for present manual and future automatic operation.

Type 21 telephones are wired for any desired type of service—straight line, harmonic, divided ring, rural—or in any combination to meet your individual needs.

For efficient, economical service in automatic exchanges,

Or fitted with dial blanks for present manual and future automatic operation.

Write for samples and prices

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Winter's storms will lay low lines that NEVER-CREEP anchors would have kept staunch and straight for you.

The lesson is dearly learned, for in too many cases the whole year's earnings are in the storm loss.

But when you rebuild these lines, and build or rebuild every line after them, install NEVER-CREEP anchors for their profit protection.

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The big holding surface of the NEVER-CREEP pulls 100% against undisturbed ground. The exclusive NEVER-CREEP feature, the patented Thimbleye, preserves the guy wire and assures a good job of guying.

Remember to make your next order from your jobber include NEVER-CREEP anchors so you can begin right away on the inevitable standardization of this anchor.

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CHANCE COMPANY

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ANCHORS SOCKET WRENCHES PROTECTORS
BACK TRUSSES BRACKETS

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